Today’s moderator

Eliz Esteban
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About Austroads

The peak organisation of Australasian road transport and traffic agencies

- Roads and Maritime Services New South Wales
- Roads Corporation Victoria
- Department of Transport and Main Roads Queensland
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Infrastructure, Planning and Logistics Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Department of Infrastructure, Regional Development and Cities
- Australian Local Government Association
- New Zealand Transport Agency
Our structure

Austroads Board

Austroads National Office

Assets Program
- Assets Task Force
- Bridge Task Force
- Pavements Task Force
- Road Tunnels Task Force
- Project Delivery Task Force

Network Program
- Network Task Force
- Freight Task Force

Safety Program
- Road Safety Task Force
- Road Design Task Force
- Registration and Licensing Task Force
- Austroads Safety Barrier Assessment Panel

Connected and Automated Vehicles
- CAV Steering Committee
- Industry Reference Group

NEVDIS
- Vehicle governance
- Licensing governance
Housekeeping

Presentation = 35 mins
Question time = 15 mins

Please type your questions here

Let us know the slide number your question relates to
Austroads report

Download from Austroads Website:

Today’s presenters

**Adrian Hart**
Associate Director, Building and Construction
BIS Oxford Economics
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**Rachael Logie**
Associate Director, Construction Consulting
BIS Oxford Economics
P: +61 2 8458 4251
E: rlogie@bisoxfordeconomics.com.au
## Agenda

<table>
<thead>
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<th>Presenter</th>
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<td>State of Play and Outlook for Roads Activity</td>
<td>Adrian Hart</td>
</tr>
<tr>
<td>Quantitative Modelling Results for Roads Skills</td>
<td>Adrian Hart</td>
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<tr>
<td>Industry Perspectives and Challenges</td>
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<tr>
<td>Q&amp;A</td>
<td>Adrian Hart &amp; Rachael Logie</td>
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</tbody>
</table>
Project Background and Introduction
Adrian Hart
Introduction to team

Project Team

Tracy Jenkinson
Austroads
Project Manager

Adrian Hart
BIS Oxford Economics

Rachael Logie
BIS Oxford Economics

Review Team

Austroads Working Group Group

Stakeholders-Road and Traffic Authorities

Austroads Board
Research Goals

- Workforce capability analysis – 10 years
- Engineering and non-engineering skills

- Quantitative modelling
- Qualitative insights from industry

- Challenges and Risks
- Recommendations
Roads Workforce Capability

- 2006 – Initial workforce capability analysis by BIS Shrapnel
- 2009 – Updated study by BIS Shrapnel
- 2013 – Updated study by BIS Shrapnel
- 2017-18 – This expanded study by BIS Oxford Economics
- 2016 – Intelligent Mobility Skills Strategy by Transport Systems Catapult (UK)
- 2017 – Highways Skills Shortage; the Ticking Time Bomb by Highways UK
- 2017 – Construction Delivery Assessment by BIS Oxford Economics for iNSW
- 2017 – Transport Skills Forecast by Transport and Logistics IRC
Our Approach in the 2017-18 Study

• Need to think beyond traditional engineering skills
• Need to consider technological trends over the next 20 years
• Implications for the role and function of existing roads agencies
• Quantitative analysis to estimate the potential size of the challenge
• Qualitative analysis to pinpoint:
  - Where skills gap may already exist
  - Where the risks to capability will likely arise
  - Future skills that may be required
  - Impact of new technologies on skills demand and requirements
Key Findings

• Roads agencies facing ‘triple threat’ to workforce capability
  1. A record program of infrastructure spending forecast
  2. Maturing technologies will impact on type of skills demanded – and funding
  3. The role and function of roads agencies is likely to change

• Agencies are already facing skills shortages
• Agencies face stiff competition for traditional and non-traditional skills
• Agencies will have time to adapt to some technological developments BUT
• Much needs to be done now to put capability on a sustainable path
State of Play and Outlook for Roads Activity
Adrian Hart
Economic Environment – Australia

- Australian economy has picked up in FY18 with domestic demand growth the key driver
- Demand fuelled by strong growth in investment and construction, particularly in housing, transport, tourism and commercial building
- Strong population growth will support demand in future, but cycles will play out by sector and state
Economic Environment – New Zealand

- Economic growth moderating in New Zealand in FY18 due to weakening investment, impacting on domestic demand
- Transport investment likely to rise based on road and rail programs and projects
- Weakening population growth to impact on demand for building activity in coming years
Total Construction – Australia

$ Billion, 2015/16 Prices

- Oil & Gas
- Engineering Construction less Oil & Gas
- Non-Residential Building
- Residential Building

Year ended June

Source: BIS Oxford Economics, ABS
Major Transport Projects > $2bn, Australia

Notes: This chart is based on projects with over $2 billion in construction work done. Solid areas are road projects, dotted areas are rail projects.

Source: BIS Oxford Economics

$ Billion (in FY15 constant prices) Forecast

Year ended June Source: BIS Oxford Economics

- SA North-South Corridor
- WA Hancock Roy Hill (Pilbara)
- WA Fortescue Metal Group (Pilbara)
- WA BHP Billiton (Pilbara)
- WA Rio Tinto (Pilbara)
- VIC Melbourne Airport Link
- VIC Inland Rail (VIC component)
- VIC Melbourne Metro Rail
- VIC Level Crossing Removal Program
- VIC Regional Rail Link
- VIC Western Distributor
- VIC EastLink
- QLD Acacia Ridge to Port of Brisbane
- QLD Cross River Rail
- QLD Inland Rail (QLD component)
- QLD Warrego Highway
- QLD Gateway Motorway
- QLD Bruce Highway Upgrade
- QLD TransApex
- QLD Ipswich Motorway
- NSW Inland Rail (NSW component)
- NSW Sydney Metro West
- NSW Sydney Metro City & Southwest
- NSW Sydney Metro Northwest
- NSW F6 Extension
- NSW Western Harbour Tunnel
- NSW Western Sydney Infrastructure Plan
- NSW NorthConnex
- NSW WestConnex
- NSW Pacific Highway Upgrade
Road Construction – Australia

Source: BIS Oxford Economics, ABS data

Funded by the
Public Sector

Funded by the
Private Sector

Total Construction

$ million

Year Ended June

Source: BIS Oxford Economics, ABS data
Road Construction by State – Australia

Source: ABS, BIS Oxford Economics

Year ended June
Civil Construction – New Zealand

Civil engineering work done

$NZ million (2009/10 prices)

Share of GDP (%)


Civil engineering, $NZ million, 2009/10 prices, (LHS)  Civil engineering % of GDP (RHS)

Source: BIS Oxford Economics, Statistics New Zealand
Road Construction – New Zealand

Source: BIS Oxford Economics, NZTA
Defining the Roads Sector

No single ‘Roads Sector’ in Census or National Accounts

Skilled labour in the roads industry comes from several sectors:

• Road and Bridge Construction
• State and Local Government
• Non-Building Construction
• Professional, Scientific and Technical Services
Defining the Roads Workforce: FYA Clusters

- Designers
- Artisans
- Generators
- Coordinators
- Carers
- Other (Informers and Technologists)

Included

Not included
# Defining the Roads Workforce

<table>
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<tr>
<th>Sector</th>
<th>Design Skills</th>
<th>Informer Skills</th>
<th>Technological Skills</th>
<th>Artisan Skills</th>
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<td>313</td>
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<td>5,350</td>
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<td>Federal Government</td>
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<td>649</td>
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<td>4,099</td>
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<td>1,230</td>
<td>286</td>
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<td>Local Government</td>
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<td>2,006</td>
<td>388</td>
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<td>Other</td>
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<td>1,302</td>
<td>1,041</td>
<td>2,109</td>
<td>7,957</td>
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<td><strong>Professional Services</strong></td>
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<td>10,476</td>
<td>27,224</td>
<td>2,821</td>
<td>63,381</td>
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<td><strong>Other Sectors</strong></td>
<td>46,952</td>
<td>26,193</td>
<td>32,593</td>
<td>66,885</td>
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<td><strong>Total All Sectors</strong></td>
<td>112,732</td>
<td>44,607</td>
<td>63,857</td>
<td>165,865</td>
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<td><strong>Total Roads Workforce</strong></td>
<td>10,540</td>
<td>3,081</td>
<td>3,945</td>
<td>7,518</td>
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<td><strong>Public Roads Workforce</strong></td>
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<td>1,734</td>
<td>469</td>
<td>6,226</td>
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Source: BIS Oxford Economics, ABS Data
## Workforce Attrition

<table>
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<tr>
<th>Age Bracket</th>
<th>Total Artisan Workforce (Australia)</th>
<th>Total Design Workforce (Australia)</th>
<th>Total Other Workforce (Australia)</th>
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<tr>
<td>15-24</td>
<td>16.7%</td>
<td>2.1%</td>
<td>1.2%</td>
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<td>25-34</td>
<td>23.9%</td>
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<td>35-44</td>
<td>24.0%</td>
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<td>45-54</td>
<td>20.6%</td>
<td>25.4%</td>
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<tr>
<td>55-59</td>
<td>7.4%</td>
<td>14.0%</td>
<td>10.8%</td>
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<tr>
<td>60-65</td>
<td>5.0%</td>
<td>9.2%</td>
<td>7.2%</td>
</tr>
<tr>
<td>65-69</td>
<td>1.8%</td>
<td>2.9%</td>
<td>1.1%</td>
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<tr>
<td>70+</td>
<td>0.6%</td>
<td>0.7%</td>
<td>0.3%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: BIS Oxford Economics, ABS Data
Workforce Gaps – Designer Cluster, Australia

Source: BIS Oxford Economics, ABS
Workforce Gaps – Designer Cluster, New Zealand

![Graph showing workforce gaps](image)

**Total Design Cluster Labour Demand**

**Existing Design Cluster Workforce**

**Design Cluster Workforce Gap**

Source: BIS Oxford Economics, Stats NZ data
Scenarios – Australian Roads Labour Demand

![Graph showing labour demand scenarios from 2017 to 2027. The graph illustrates scenarios with different productivity growth rates: zero, 1%, and 1.5%. The data is sourced from BIS Oxford Economics, ABS.](image-url)
Technology Scenarios

Constrained World

• Higher technological disruption
• Constrained response from governments and agencies
• Increased road use and limited funding

Technology and Response

• Higher technological disruption
• Full policy response by governments and agencies
• More efficient use of roads and greater funding
Technology Scenarios

Constrained World

• Higher construction and maintenance requirements
• Weaker productivity growth in the long term
• Increased share of designer skills at expense of other skills

Technology and Response

• Lower construction and maintenance requirements
• Stronger productivity growth in the long term
• Reduced share of designer skills and higher share of other skills
Scenarios – Design Cluster, Australia

Source: BIS Oxford Economics, ABS
Scenarios – Artisan Cluster, Australia

Source: BIS Oxford Economics, ABS
Scenarios – Other Cluster, Australia

Year Ended June

Source: BIS Oxford Economics, ABS
Quantitative Modelling Results

Baseline Scenario (Business as Usual)
• Rising workforce gaps for all skills clusters, worsening long term (after FY22)

Technology and Response Scenario
• Much higher workforce gap for Informers and Technologists
• Lower workforce gaps for Designers and Artisans

Constrained World Scenario
• Lower workforce gap for Other skills initially, but higher longer term
• Higher workforce gaps for Designers and Artisans
Limitations of Modelling

Assumes ‘equilibrium’ in the base year (2016/17)

- Evidence points to skills shortages being already apparent

Does not adequately reflect the loss of highly skilled labour

- Workers with many years of experience will retire over the coming decade
- Assumes skills can be replaced by new graduates, migration or industry

May not adequately reflect pull on resources from other industries

- Risks ahead from large rail investment programme
- Other sectors (e.g. mining) may also pull labour from roads industry
Please type your questions here

Let us know the slide number your question relates to
Industry Perspectives and Challenges
Adrian Hart
Qualitative Methodology

Industry liaison to address limitations to quantitative approaches
• Includes other industries, education, local government, agencies

Industry Survey
• Quantitative feedback on industry issues, risks and potential solutions
• Use of Likert scales to rank results

Deeper Dive Interviews
• 32 interviews conducted through September - November 2017
• Key themes developed
• Confidentialised responses directly included into report
Survey Results – Level of Recruiting Difficulty

Design skills – University trained

<table>
<thead>
<tr>
<th>Position</th>
<th>V Low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>V High</th>
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<tr>
<td>Other Engineering Professionals</td>
<td>4.5</td>
<td></td>
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<tr>
<td>Other Spatial Scientist</td>
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<tr>
<td>Cartographer</td>
<td>3.3</td>
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<td>Surveyor</td>
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<td>Mechanical Engineers</td>
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<td>Transport Engineer</td>
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<td>Structural Engineer</td>
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<td>Quantity Surveyor</td>
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<td>Geotechnical Engineer</td>
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<td>Civil Engineer</td>
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<td>Engineering Manager</td>
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<td>Construction Project Manager</td>
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Inform, Technological and Artisan skills

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<th>Position</th>
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<td>Mobile Plant Operators</td>
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<tr>
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<tr>
<td>Urban and Regional Planners</td>
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</table>

Design skills – University trained

Inform, Technological and Artisan skills
Survey Results – Where Will Shortages Arise?

Risks in Roads Agencies

- Other Engineering Professionals: 4.3
- Other Spatial Scientist: 4.5
- Cartographer: 5.0
- Surveyor: 4.8
- Mechanical Engineers: 4.3
- Transport Engineer: 4.0
- Structural Engineer: 4.2
- Quantity Surveyor: 5.0
- Geotechnical Engineer: 3.8
- Civil Engineer: 4.0
- Engineering Manager: 4.5
- Construction Project Manager: 4.6

Risks in Other Industries

- Other Engineering Professionals: 3.5
- Other Spatial Scientist: 3.2
- Cartographer: 4.0
- Surveyor: 4.0
- Mechanical Engineers: 3.6
- Transport Engineer: 4.3
- Structural Engineer: 3.8
- Quantity Surveyor: 3.8
- Geotechnical Engineer: 4.2
- Civil Engineer: 3.8
- Engineering Manager: 4.1
- Construction Project Manager: 4.1
Survey Results – Where Will Shortages Arise?

**Roads Agencies**

<table>
<thead>
<tr>
<th>Role</th>
<th>V Low</th>
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**Other Industries**

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</table>
Insights from Industry Interviews

Existing skills shortages

- ‘On site’ engineering and construction skills – contractors & local government
- Estimators and project controls
- Pavement engineering – local government
- Procurement (informed purchaser) – agencies and local government
- Data management and tactical / real time network operations
- Transport economists
- Asset management
Insights from Industry Interviews

Future Skills Required

• Asset management skills to provide holistic approach to custodianship
• Network operations skills – both tactical and in real time
• Technological skills to develop and secure data systems
• Analytical skills to interpret large volumes of data and make decisions
• Economics skills to develop robust business cases and funding methods
• Behavioural skills to anticipate human reactions to new technologies
• ‘Soft skills’ to communicate ideas & solve problems in midst of disruption
• Asset management
Insights from Industry Interviews

Impact of New Technologies

- CAV ranked biggest threat – engineering, legal, commercial skills
- CAV also to change regulatory environment – prescriptive vs outcomes based
- CAV impact on funding
- Transition period to CAV – long period of mixed use
- Impact of C-ITS, MaaS and electric vehicles
- Moving data and services online
Insights from Industry Interviews

Other Risks to Workforce Capability Identified

- Inability to attract skills due to pay or regional differences
- Demographic and cultural challenges
- Insufficient or mismatched skills from the education sector
- Institutional roadblocks
- Need to develop partnering culture
Report Recommendations
Adrian Hart
## Potential Timing of Capability Threats

<table>
<thead>
<tr>
<th></th>
<th>0-5 years (to 2022)</th>
<th>5-10 years (to 2027)</th>
<th>10-20 years (to 2037)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand / supply pressures</strong></td>
<td></td>
<td></td>
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<tr>
<td>Rising level of roads activity</td>
<td>Sustained high roads activity</td>
<td>Rising maintenance tasks</td>
<td></td>
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<tr>
<td>Competing industry demands</td>
<td>Competing industry demands</td>
<td>Unknown</td>
<td></td>
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<tr>
<td>Rapidly ageing workforce</td>
<td>Rapidly ageing workforce</td>
<td>Ageing workforce</td>
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<tr>
<td>Falling rates of migration</td>
<td>Stabilising rates of migration</td>
<td>Unknown</td>
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<tr>
<td>Falling STEM study in schools</td>
<td>Unknown</td>
<td>Unknown</td>
<td></td>
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<tr>
<td><strong>Vehicle technologies (C.A.S.E.)</strong></td>
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<tr>
<td>ITS only</td>
<td>Emerging C-ITS</td>
<td>C-ITS</td>
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<tr>
<td>Mostly semi-autonomous vehicles</td>
<td>Emerging Level 4 and 5 CAV</td>
<td>Increasing share of Level 4 and 5 CAV</td>
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<tr>
<td>Ride sharing services (e.g. Uber)</td>
<td>Emerging MaaS systems</td>
<td>Advanced MaaS systems</td>
<td></td>
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<tr>
<td>Mostly non-electric vehicles (EVs)</td>
<td>Increasing share of EVs</td>
<td>Majority of new vehicles sold are EVs</td>
<td></td>
</tr>
<tr>
<td><strong>Other technologies</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Big data and BIM</td>
<td>Big data and BIM / systems</td>
<td>Machine learning and AI</td>
<td></td>
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<tr>
<td><strong>Agency role and function</strong></td>
<td></td>
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<tr>
<td>Roads and Transport</td>
<td>Increasing Transport integration</td>
<td>Transport and Liveable Cities</td>
<td></td>
</tr>
<tr>
<td>Highly prescriptive regulation</td>
<td>Increasing outcomes approaches</td>
<td>Non-prescriptive regulation</td>
<td></td>
</tr>
<tr>
<td>Engineering &amp; network operations</td>
<td>Increasing ops &amp; asset management</td>
<td>Optimising transport networks and use</td>
<td></td>
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<tr>
<td><strong>Funding / road user charging</strong></td>
<td></td>
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<tr>
<td>Licencing and fuel taxes</td>
<td>Introducing heavy vehicle RUC</td>
<td>Introducing broad-based RUC</td>
<td></td>
</tr>
</tbody>
</table>
Challenges and Potential Solutions

Meeting ‘traditional’ skills challenges

• Maximising industry skills base – pipelines, procurement, education & training
• Using procurement as a skills strategy
• Targeting skills in regional areas – pooling, cadetships, network opportunities
• Strengthening workforce retention – at all life cycle stages
Challenges and Potential Solutions

Meeting ‘non-traditional’ skills challenges

• Stronger engagement with the education sector
• Partnering with industry

“the answer may be… to identify ways we can bring in others to solve problems. We can be a good broker, rather than trying to do it all.”
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Please type your questions here

Let us know the slide number your question relates to
Questions?

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<th>Date</th>
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<tr>
<td>Minimum Levels of Componentisation for Road Infrastructure Assets</td>
<td>11 September</td>
</tr>
<tr>
<td>Guide to Project Delivery Part 5: Road Construction Quality Assurance</td>
<td>20 September</td>
</tr>
<tr>
<td>Operations of Automated Heavy Vehicles in Remote and Regional Areas</td>
<td>25 September</td>
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