Today’s moderator

Eliz Esteban
Communications Officer
Austroads

P: +61 2 8265 3302
E: eesteban@austroads.com.au
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 Transport Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Commonwealth 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 = 40 mins
Question time = 10 mins

Please type your questions here

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

Download from Austroads Website:

Today’s presenter

Dr Michael Moffatt
National Technical Leader
Pavements and Surfacings
ARRB

P: +61 3 9881 1650
E: michael.moffatt@arrb.com.au
## Agenda

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Background and Introduction</td>
<td></td>
</tr>
<tr>
<td>Guide to Pavement Technology Part 2: Pavement Structural Design</td>
<td>Dr Michael Moffatt</td>
</tr>
<tr>
<td>• Lime Stabilised Subgrades</td>
<td></td>
</tr>
<tr>
<td>• Cemented Materials</td>
<td></td>
</tr>
<tr>
<td>• Lean-mix Concrete</td>
<td></td>
</tr>
<tr>
<td>• Asphalt Characterisation</td>
<td></td>
</tr>
<tr>
<td>• Design Traffic</td>
<td></td>
</tr>
<tr>
<td>• Axle Strain Method (ME bound materials)</td>
<td></td>
</tr>
<tr>
<td>Guide to Pavement Technology Part 4C: Materials for Concrete Road Pavements</td>
<td></td>
</tr>
<tr>
<td>Q&amp;A</td>
<td></td>
</tr>
</tbody>
</table>
Project Background and Introduction
Evolution of Guide to Pavement Technology Part 2

1979
1987
1992
2004
2008
2010
2012
2002 – 2018 Reports
Introduction to Team

Project Team

Austroads Project Manager
Andrew Papacostas
VicRoads

Project Leader
Michael Moffatt
ARRB

Team Member
Geoff Jameson
ARRB

Review Team

Austroads Pavements Structures Working Group

Austroads Pavements Task Force

Stakeholders - Road & Traffic Authorities & Industry

Austroads Board
Overview of Part 2 changes

Flexible pavements
- Lime stabilised subgrades
- Cemented materials
- Lean-mix concrete
- Asphalt
- Design traffic
- Removal of Standard Axle Repetitions (SARs)
- Axle-strain method

Rigid pavements
- Joint detailing diagrams
Lime Stabilised Subgrades
Lime Stabilised Subgrades

2012

- Lime stabilised subgrades not structural

2013

- Researched methods
- Lime stabilised subgrades = selected subgrades ≠ subbase layers
- ME procedure
- Empirical procedure
Adoption in 2017

Only applicable if:

- Lime provides long term strength
- Lime content meets lime demand test (lime content when pH = 12.4)
- Minimum CBR of 60%

Allows maximum E = 150 MPa

Lime stabilised subgrade considered in same way as selected materials
Cemented Materials
2012 Design Modulus

- In situ flexural modulus
  - after 28 days curing in roadbed

- Estimated
  - Unconfined Compressive Strength (UCS) tests
  - Presumptive values
2017 Design Modulus

- In situ flexural modulus
  - after 90 days curing in roadbed
- Measured
  - 4-point flexural beam
  - Lab-field adjustment factor
- Estimated
  - Unconfined Compressive Strength (UCS) tests
  - Presumptive values
2012 Fatigue Performance

- Applied tensile strain
- Modulus
- Project reliability

\[ N = RF \left[ \frac{113000}{E^{0.804}} + 191 \right]^{12} \]
2012 Fatigue Performance

Tolerable strain at fatigue life of 100,000 cycles (microstrain)

Design modulus (MPa)
4-point Beam Testing: Modulus

Tolerable strain at fatigue life of 100,000 cycles (microstrain)

- RCC3 = recycled crushed conc. 3% cement
- BAP3 = basalt (Purga) 3% cement
- MPSG3 = modified prior stream gravel 3% cement
- HO3 = hornfels 3% cement
- PSG5 = prior stream gravel 5% cement
- WG3 = weathered granite 3% cement
- WG5 = weathered granite 5% cement
- QZ4 = quartzite 4% cement
- CL3 = calcareous limestone 3% cement
- CL5 = calcareous limestone 5% cement
- BAM3 = basalt (Mt Gambier) 3% cement

Flexural modulus (MPa)

Design modulus (MPa)

Tolerable strain at fatigue life of 100,000 cycles (microstrain)
4-point Beam Testing: Modulus + Strength

Tolerable strain at fatigue life of 100,000 cycles (microstrain)

Measured tolerable strain at fatigue life of 100,000 cycles (microstrain)

Predicted tolerable strain at fatigue life of 100,000 cycles (microstrain)

Strains prediction model:
Strain = 62.785 + 72770/1.746

Measured flexural strength (FS) and flexural modulus (E) in MPa:
$R^2 = 0.93$, std error = 4 microstrain
2017 Fatigue Performance

3 methods

\[ N = RF \left( \frac{K}{\varepsilon} \right)^{12} \]

1. Fatigue measurements (inc. lab-field factor)
2. Estimated from measurements of flexural strength & modulus (inc. lab-field factor)
3. Presumptive values (No RF)

Same as 2012
Lean-mix Concrete
2012 Cemented materials

Cemented materials type included lean-mix concrete

\[ N = RF \left[ \frac{113000}{E^{0.804}} + 191 \right]^{12} \]
2017 Cemented materials

- Lean-mix concrete a separate material type
- Presumptive values
2012 Design Modulus

Estimate of the value obtained from either:

- Resilient modulus measured using the standard indirect tensile test (ITT) adjusted to in-service temperature and rate of loading
- Estimation from bitumen properties using Shell nomographs and in-service temperature and rate of loading
2017 Design Modulus

- Retains both methods
- Clarifies that both yield a flexural modulus (built into rate of loading adjustment)
- Adds direct measurement of flexural modulus
2017 Design Modulus

1. Flexural modulus measurement at in-service speed and temperature (WMAPT)
2. Interpolation from measured flexural modulus over a wide range of speed and temperatures
3. Measure ITT as in 2012 Guide
4. Estimation from Shell nomographs as in 2012 Guide
2012 Fatigue Performance

\[ N = RF \left[ \frac{6918(0.856V_b + 1.08)}{E^{0.36}\varepsilon} \right]^5 \]

**Desired project reliability**

<table>
<thead>
<tr>
<th>80%</th>
<th>85%</th>
<th>90%</th>
<th>95%</th>
<th>97.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>2.0</td>
<td>1.5</td>
<td>1.0</td>
<td>0.67</td>
</tr>
</tbody>
</table>
2017 Fatigue Performance

\[ N = \frac{SF}{RF} \left[ \frac{6918(0.856V_b + 1.08)}{E^{0.36}\varepsilon} \right]^5 \]

Presumptive \( SF = 6 \)

<table>
<thead>
<tr>
<th>Desired project reliability</th>
<th>50%</th>
<th>80%</th>
<th>85%</th>
<th>90%</th>
<th>95%</th>
<th>97.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>1.0</td>
<td>2.4</td>
<td>3.0</td>
<td>3.9</td>
<td>6.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>
2017 Fatigue Performance

- Guidance on using laboratory measured fatigue performance in design
- Requires understanding relationship between lab and field performance

<table>
<thead>
<tr>
<th>WMAPT (°C)</th>
<th>≤ 25</th>
<th>26 - 34</th>
<th>≥ 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design traffic limit (ESA)</td>
<td>$4 \times 10^8$</td>
<td>$2 \times 10^8$</td>
<td>$10^8$</td>
</tr>
</tbody>
</table>
Please type your questions here

Let us know the slide number your question relates to
Design Traffic
Check that:
Annual number of Heavy Vehicles ≤ lane capacity

Simple approach adopted:
Capacity is when flows mean that road is saturated 24 h/day
Axle Strain Method
Mechanistic Empirical (ME) Bound Materials
2012 Axle Strain Method (ME Bound Materials)

- Calculate strain only under a 80 kN Standard Axle load
- Calculate allowable traffic loading under 80 kN Standard Axle load
- Design traffic needed to be expressed in terms of repetitions of a Standard Axle
- Cumulative traffic over design period includes various axle group types and loads
2012 Axle Strain Method (ME Bound Materials)

- From strains calculate the **allowable loading** in terms Standard Axle Repetitions
- Hence, express the **design traffic** in Standard Axles Repetitions of damage

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.0101</td>
<td>1.0001</td>
<td>0.0900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1.2666</td>
<td>1.5502</td>
<td>0.2100</td>
<td>0.0200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2.5342</td>
<td>1.5614</td>
<td>0.4600</td>
<td>0.0300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>13.9123</td>
<td>14.6145</td>
<td>1.7100</td>
<td>0.1100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>13.8717</td>
<td>14.8615</td>
<td>0.1448</td>
<td>2.5000</td>
<td>0.6000</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>18.4911</td>
<td>13.5814</td>
<td>1.5317</td>
<td>4.1100</td>
<td>2.0900</td>
<td>0.5539</td>
</tr>
<tr>
<td>70</td>
<td>20.6708</td>
<td>10.5311</td>
<td>5.6481</td>
<td>5.7500</td>
<td>3.6800</td>
<td>0.5539</td>
</tr>
<tr>
<td>80</td>
<td>14.8445</td>
<td>9.1009</td>
<td>9.0824</td>
<td>7.0100</td>
<td>5.2800</td>
<td>0.3728</td>
</tr>
<tr>
<td>90</td>
<td>4.4888</td>
<td>7.1007</td>
<td>8.7825</td>
<td>6.8800</td>
<td>5.6500</td>
<td>2.2262</td>
</tr>
<tr>
<td>100</td>
<td>5.3405</td>
<td>10.6031</td>
<td>6.2300</td>
<td>5.2800</td>
<td>5.9438</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>3.7704</td>
<td>13.1271</td>
<td>5.6300</td>
<td>4.8400</td>
<td>9.8530</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>2.3202</td>
<td>13.5366</td>
<td>4.7000</td>
<td>4.3200</td>
<td>18.4065</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>1.4901</td>
<td>14.1202</td>
<td>4.7600</td>
<td>4.3300</td>
<td>12.6438</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>0.7801</td>
<td>10.9341</td>
<td>4.7000</td>
<td>3.8800</td>
<td>5.3899</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>0.3500</td>
<td>6.6205</td>
<td>4.9700</td>
<td>3.8900</td>
<td>2.7908</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>3.7550</td>
<td>5.5600</td>
<td>4.1600</td>
<td>2.5991</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>2.0585</td>
<td>5.4800</td>
<td>3.9000</td>
<td>2.0452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180</td>
<td></td>
<td></td>
<td>5.7200</td>
<td>4.3000</td>
<td>0.7456</td>
<td></td>
</tr>
<tr>
<td>190</td>
<td></td>
<td></td>
<td>5.1800</td>
<td>4.3000</td>
<td>1.6723</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
<td>4.8300</td>
<td>4.6000</td>
<td>1.2995</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>4.4200</td>
<td>5.2400</td>
<td>0.5539</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td></td>
<td></td>
<td>3.2700</td>
<td>5.1800</td>
<td>1.1184</td>
<td></td>
</tr>
</tbody>
</table>

80 kN

Standard Axle

equivalent Standard Axle Repetitions
2012 Axle Strain Method (ME Bound Materials)

\[ SAR = \sum_{i=1}^{m} \left( \frac{L_i}{SL_i} \right)^{LDE} \]

<table>
<thead>
<tr>
<th>Axle type</th>
<th>Standard group load [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>single axle – single tyres</td>
<td>53</td>
</tr>
<tr>
<td>single axle – dual tyres</td>
<td>80</td>
</tr>
<tr>
<td>tandem – dual tyres</td>
<td>135</td>
</tr>
<tr>
<td>triaxle – dual tyres</td>
<td>181</td>
</tr>
<tr>
<td>quad-axle – dual tyres</td>
<td>221</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distress type</th>
<th>LDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>asphalt fatigue</td>
<td>5</td>
</tr>
<tr>
<td>cemented material /LMC fatigue</td>
<td>12</td>
</tr>
<tr>
<td>rutting and shape loss</td>
<td>7</td>
</tr>
</tbody>
</table>
Shortcomings of 2012 Method

• Standard loads used to determine SAR independent based on equal deflection
• Standard loads assumed equal maximum deflection equals equal damage
  – Regardless of number of occurrences of that deflection (i.e. Axles with group)
• Design method equates damage to strains not deflections
• Standard loads independent of structure
  – Strains vary with pavement structure
2017 Method

- **Design traffic** - expressed as the expected number of repetition for each axle load on each axle group type
- **Allowable loading in terms of fatigue damage** - calculated for each axle load on each axle group type
- **Fatigue damage** - calculated by dividing the expected repetitions by the allowable repetitions

**Table L 11: Calculation of asphalt damage – single axle/dual tyres (SADT) – full depth asphalt pavement**

<table>
<thead>
<tr>
<th>Axle group load (kN)</th>
<th>Expected group repetitions</th>
<th>Axles in group</th>
<th>Critical strain (microstrain)</th>
<th>Allowable group repetitions</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>66 334</td>
<td>1</td>
<td>21.9</td>
<td>2.06E+11</td>
<td>1.14E-09</td>
</tr>
<tr>
<td>20</td>
<td>166 094</td>
<td>1</td>
<td>43.8</td>
<td>6.42E+09</td>
<td>1.45E-07</td>
</tr>
<tr>
<td>30</td>
<td>448 086</td>
<td>1</td>
<td>65.6</td>
<td>8.46E+08</td>
<td>1.19E-06</td>
</tr>
<tr>
<td>40</td>
<td>418 863</td>
<td>1</td>
<td>87.5</td>
<td>2.01E+08</td>
<td>1.59E-05</td>
</tr>
<tr>
<td>50</td>
<td>320 889</td>
<td>1</td>
<td>109.4</td>
<td>6.58E+07</td>
<td>1.66E-04</td>
</tr>
<tr>
<td>60</td>
<td>183 475</td>
<td>1</td>
<td>131.3</td>
<td>2.64E+07</td>
<td>5.82E-04</td>
</tr>
<tr>
<td>70</td>
<td>124 150</td>
<td>1</td>
<td>153.1</td>
<td>1.22E+07</td>
<td>1.45E-03</td>
</tr>
<tr>
<td>80</td>
<td>88 299</td>
<td>1</td>
<td>175.0</td>
<td>6.27E+06</td>
<td>2.52E-03</td>
</tr>
<tr>
<td>90</td>
<td>56 708</td>
<td>1</td>
<td>196.9</td>
<td>3.48E+06</td>
<td>3.54E-03</td>
</tr>
<tr>
<td>100</td>
<td>26 606</td>
<td>1</td>
<td>218.8</td>
<td>2.08E+06</td>
<td>5.70E-03</td>
</tr>
<tr>
<td>110</td>
<td>7 827</td>
<td>1</td>
<td>240.6</td>
<td>1.28E+06</td>
<td>7.95E-03</td>
</tr>
<tr>
<td>120</td>
<td>2 212</td>
<td>1</td>
<td>262.5</td>
<td>8.26E+05</td>
<td>1.17E-02</td>
</tr>
<tr>
<td>130</td>
<td>466</td>
<td>1</td>
<td>284.4</td>
<td>5.54E+05</td>
<td>1.72E-02</td>
</tr>
</tbody>
</table>

Total SADT damage 0.271
2017 Method

- Consistent with method used for concrete pavements

<table>
<thead>
<tr>
<th>Axle Load (kN)</th>
<th>Design Load (kN)</th>
<th>Expected Repetitions</th>
<th>Equivalent Stress</th>
<th>Stress Ratio Factor</th>
<th>Fatigue Analysis</th>
<th>Erosion Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>169.0</td>
<td>2,361</td>
<td>5,668</td>
<td>0.726</td>
<td>41.66</td>
<td>197,614</td>
</tr>
<tr>
<td>120</td>
<td>156.0</td>
<td>4,990</td>
<td>21,487</td>
<td>0.171</td>
<td>23.23</td>
<td>331,752</td>
</tr>
<tr>
<td>110</td>
<td>143.0</td>
<td>7,673</td>
<td>81,994</td>
<td>0.171</td>
<td>9.36</td>
<td>605,940</td>
</tr>
<tr>
<td>100</td>
<td>130.0</td>
<td>9,069</td>
<td>371,291</td>
<td>0.171</td>
<td>2.44</td>
<td>1,261,027</td>
</tr>
<tr>
<td>90</td>
<td>117.0</td>
<td>20,606</td>
<td>6,279,485</td>
<td>0.171</td>
<td>0.33</td>
<td>3,320,332</td>
</tr>
<tr>
<td>80</td>
<td>104.0</td>
<td>92,189</td>
<td>UNLIMITED</td>
<td>0.00</td>
<td>0.00</td>
<td>15,721,676</td>
</tr>
<tr>
<td>70</td>
<td>91.0</td>
<td>1,018,852</td>
<td>UNLIMITED</td>
<td>0.00</td>
<td>0.00</td>
<td>UNLIMITED</td>
</tr>
</tbody>
</table>
2017 Calculation of Allowable Repetitions to Fatigue

• Simplifications
  – Assume axles act in isolation to each other
  – Assume strains linearly proportional to load
• Requires two response-to-load calculations
For each axle group type and load level

- Predict strain under each isolated axle
- Use fatigue relationship to predict the allowable repetitions considering number of axles in the group

\[
N_{ij} = \frac{1}{n} \times \frac{SF}{RF} \left[ \frac{6918(0.856V_b + 1.08)}{E^{0.36}\mu\varepsilon_{ij}} \right]^5
\]

<table>
<thead>
<tr>
<th>Axle group load (kN)</th>
<th>Expected group repetitions</th>
<th>Axles in group</th>
<th>Critical strain (microstrain)</th>
<th>Allowable group repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3740</td>
<td>2</td>
<td>10.9</td>
<td>3.29E+12</td>
</tr>
<tr>
<td>20</td>
<td>14905</td>
<td>2</td>
<td>21.9</td>
<td>1.03E+11</td>
</tr>
<tr>
<td>30</td>
<td>16167</td>
<td>2</td>
<td>32.8</td>
<td>1.35E+10</td>
</tr>
<tr>
<td>40</td>
<td>51204</td>
<td>2</td>
<td>43.8</td>
<td>3.21E+09</td>
</tr>
<tr>
<td>50</td>
<td>168246</td>
<td>2</td>
<td>54.7</td>
<td>1.05E+09</td>
</tr>
<tr>
<td>60</td>
<td>246335</td>
<td>2</td>
<td>65.6</td>
<td>4.23E+08</td>
</tr>
<tr>
<td>70</td>
<td>283346</td>
<td>2</td>
<td>76.6</td>
<td>1.96E+08</td>
</tr>
<tr>
<td>80</td>
<td>253017</td>
<td>2</td>
<td>87.5</td>
<td>1.00E+08</td>
</tr>
<tr>
<td>90</td>
<td>197125</td>
<td>2</td>
<td>98.4</td>
<td>5.57E+07</td>
</tr>
<tr>
<td>100</td>
<td>187568</td>
<td>2</td>
<td>109.4</td>
<td>3.29E+07</td>
</tr>
<tr>
<td>110</td>
<td>162315</td>
<td>2</td>
<td>120.3</td>
<td>2.04E+07</td>
</tr>
<tr>
<td>120</td>
<td>154157</td>
<td>2</td>
<td>131.3</td>
<td>1.32E+07</td>
</tr>
<tr>
<td>130</td>
<td>152240</td>
<td>2</td>
<td>142.2</td>
<td>8.86E+06</td>
</tr>
</tbody>
</table>
Empirical design chart

- Permanent deformation

Mechanistic-empirical method

- Asphalt
- Cemented materials
- Lean-mix concrete
- Permanent deformation

\[
N_{\text{Standard Axle}} = \left( \frac{9300}{\mu \varepsilon} \right)^7 \quad \Rightarrow \quad N_{\text{ESA}} = \left( \frac{9150}{\mu \varepsilon} \right)^7
\]
Example of Asphalt Thickness Changes

Asphalt (3000 MPa)

200 mm Crushed rock (high quality)

Subgrade (CBR 5%)

TLD: Kwinana Fwy (Mandurah) South
Cemented Materials Thickness Changes

Including lean-mix concrete

• Similar to asphalt, the use of the axle-strain method would have resulted in a general decrease in cemented materials thicknesses.

• The thickness decrease varies with the traffic load distribution, being greater for distribution in which tandem axles and triaxles caused greater fatigue damage.

• Experienced road agency practitioners advised:
  − they agreed the axle-strain method provided an improved method of assessing fatigue damage.
  − but there was no evidence in support of a general reduction in cemented materials thickness.
Overview of Part 2 changes

**Flexible pavements**
- Lime stabilised subgrades
- Cemented materials
- Lean-mix concrete
- Asphalt
- Design traffic
- Removal of Standard Axle Repetitions (SARs)
- Axle-strain method

**Rigid pavements**
- Joint detailing diagrams
Guide to Pavement Technology Part 4C
Materials for Concrete Road Pavements

Austroads
Introduction to team

Project Team

Austroads Project Manager
Andrew Papacostas
VicRoads

Project Leader
Michael Moffatt
ARRB

Team Member
George Vorobieff
Head to Head International

Review Team

Austroads Pavements Structures Working Group

Austroads Pavements Task Force

Stakeholders - Road & Traffic Authorities & Industry

Austroads Board
Key changes

- Diagrams updated and made consistent with Roads and Maritime Services (RMS) practice
- Reference made to geopolymer cements
- References updated
- Minor editorial changes
Questions?

Dr Michael Moffatt
National Technical Leader
Pavements and Surfacings
ARRB

P: +61 3 9881 1650
E: michael.moffatt@arrb.com.au
## Upcoming Austroads webinar

<table>
<thead>
<tr>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Road Access for High Productivity Freight Vehicles</td>
<td>27 March</td>
</tr>
<tr>
<td>Geopolymer Concrete and its Applications</td>
<td>1 May</td>
</tr>
</tbody>
</table>

Thank you for participating