National Performance-based Asphalt Specification Framework

27 February 2018

Austroads

Today’s moderator

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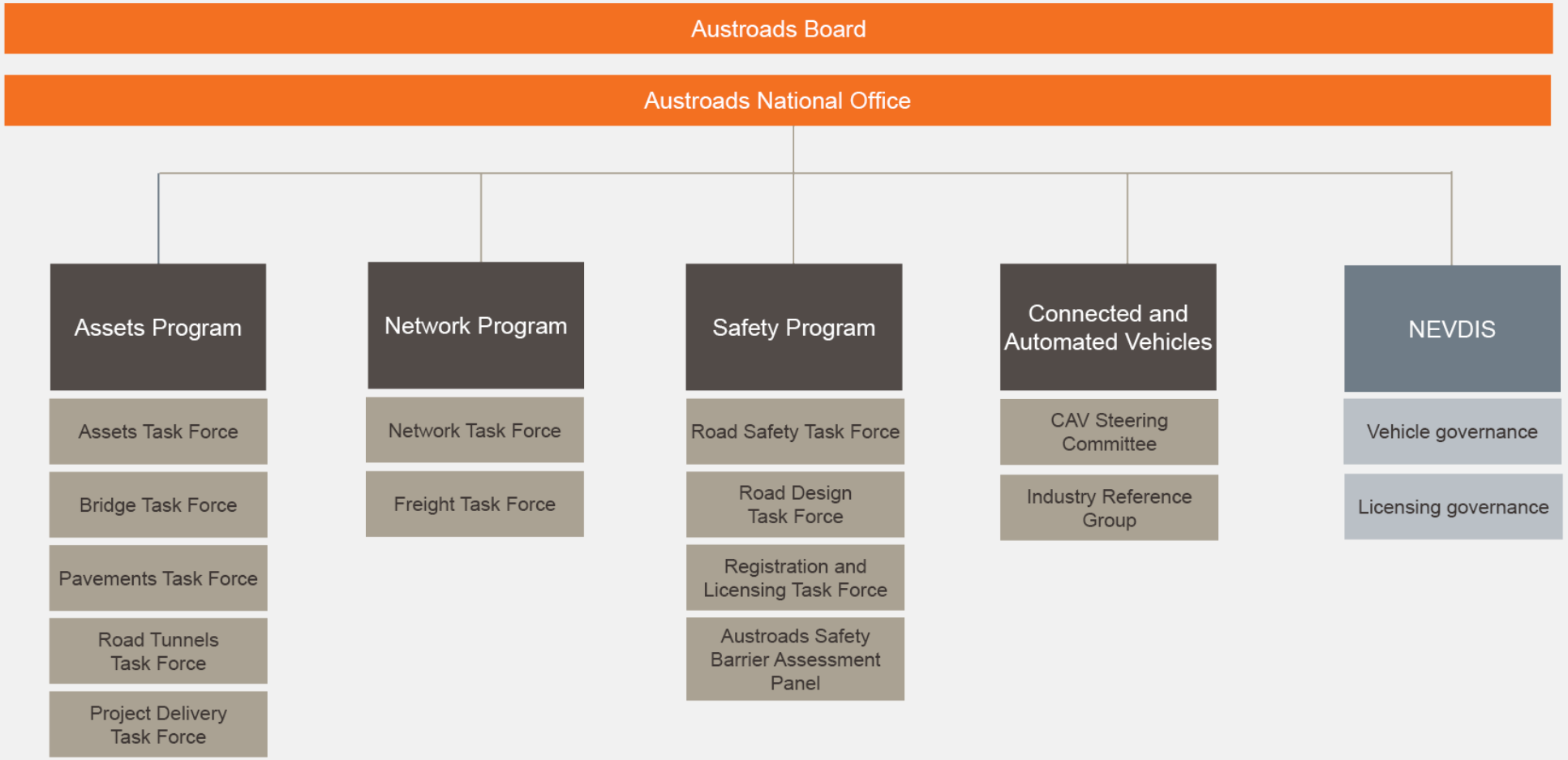
About Austroads

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 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

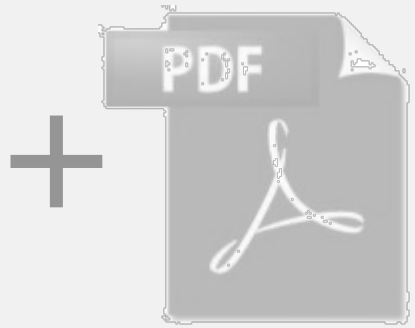
Our structure



Housekeeping

Presentation = 35 mins

Question time = 15 mins



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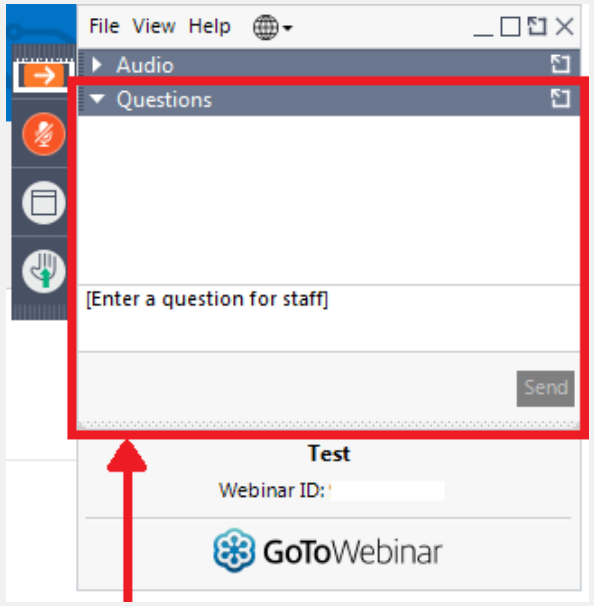

Please type your questions here

Let us know the slide number your question relates to

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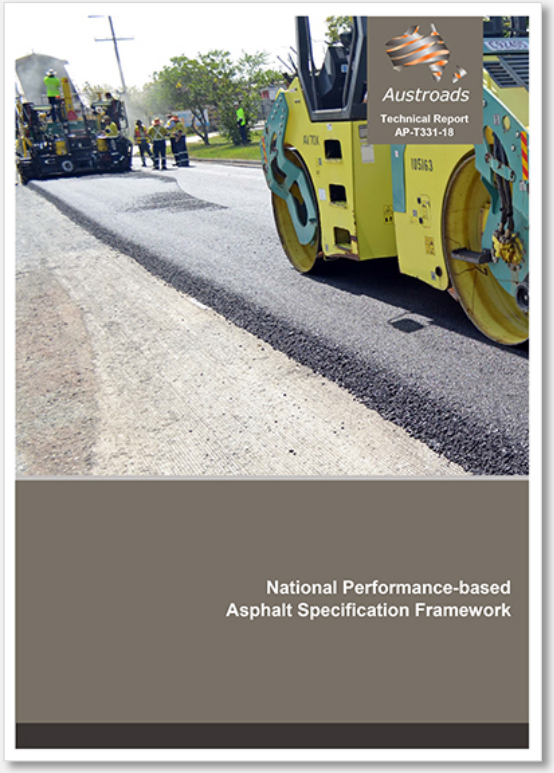

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Today’s presenter

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Agenda

Topic	Presenter
Project Background and Introduction	Joe Grobler
Current Austroads Mix Design Procedure	
Performance-based Specifications	
Proposed Concept Specification Framework	
Future Research Needs	
Summary	
Q&A	Joe Grobler Dr Richard Yeo

Project Background and Introduction

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Introduction to team

Project Team

Austroads
Project Manager
Paul Morassut

Project Leader, ARRB
Joe Grobler

Team Members
Dr Michael Moffatt
Dr Erik Denneman
John Rebbechi

Review Team

Austroads
Pavements Task Force

Austroads Asphalt
Research Working Group

Stakeholders -
Road and Traffic
Authorities

Stakeholders - Industry

Austroads Board

The Project Team

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Austroads Pavements Task Force

Road and Traffic Authorities

The Project Team

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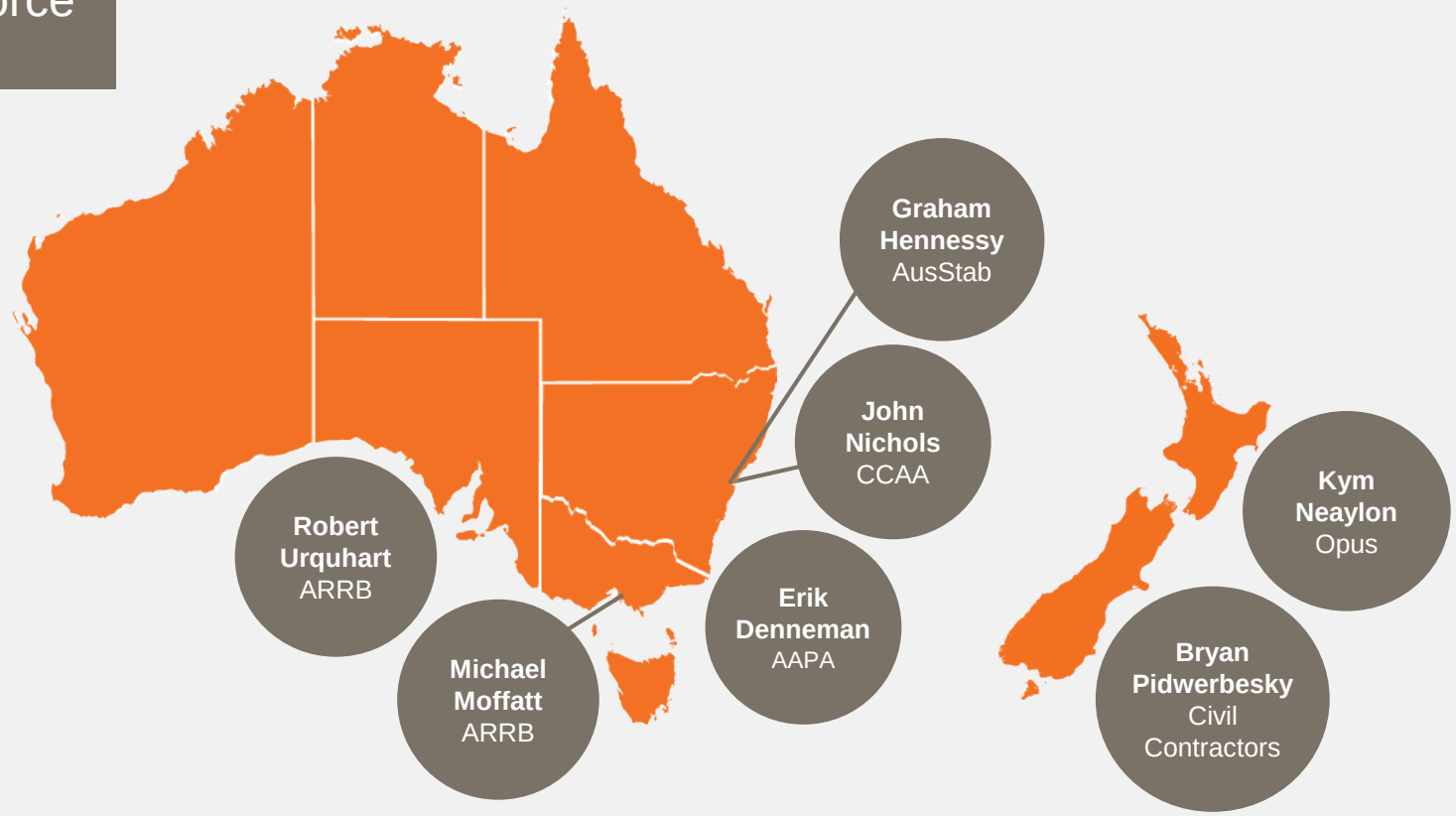
Austroads Pavements Task Force
Industry



Project overview

See Section 1

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Aims

- Develop a national performance-based asphalt specification framework
- Set an agreed direction for future research required to develop a performance-based specification framework

Objectives

1. Review and summarise existing knowledge base
2. Review previous barriers to implementing a national asphalt mix design procedure
3. Achieve national consensus on a performance-based mix design approach
4. Lay the foundation for further research

Project background

- Multi-year project
- First year focussed on:
  - stakeholder consultation
  - identifying gaps in the current knowledge base
  - propose a concept performance-based asphalt specification framework
  - identifying future research needs to further develop a national performance-based asphalt specification framework

Current Austroads Mix Design Procedure

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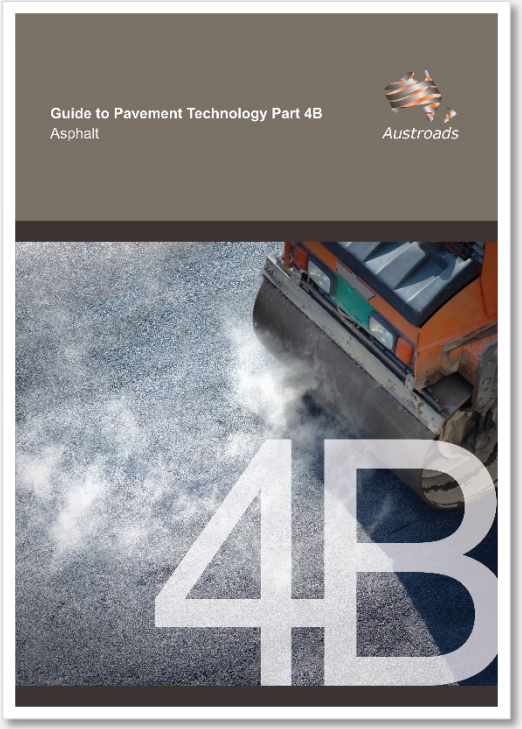
Austroads mix design procedure

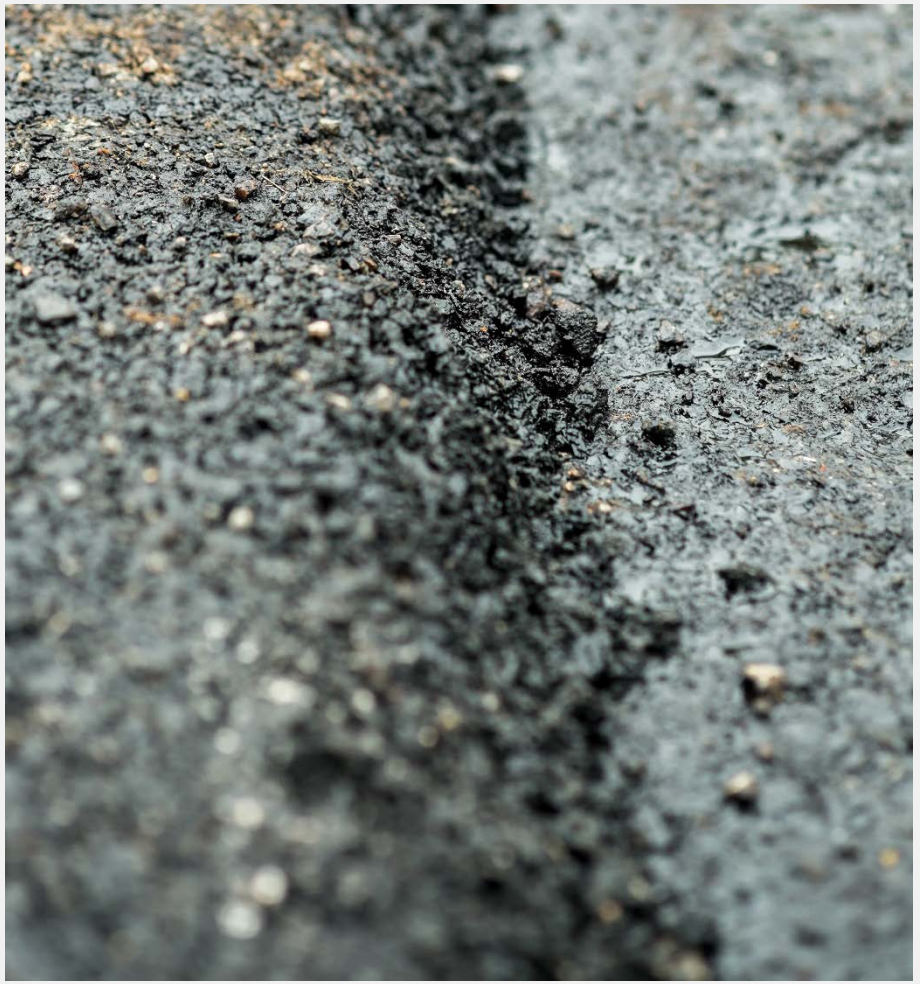
See Section 2.1.3

- Austroads Guide to Pavement Technology 4B *Asphalt*
- Level 1 testing:
  - Volumetric testing
  - Gyratory (AS 2891.2.2) or Marshall (AS 2891.5) compaction
- Level 2 testing (optional):
  - Performance testing



Performance testing

1. Resilient modulus
   - indirect tensile test (AS 2891.13.1)
2. Deformation resistance
   - wheel tracking (AG:PT/T231)
3. Stripping potential
   - tensile strength ratio (AG:PT/T232)
4. Fatigue life
   - four-point bending test (AG:PT/T233)



Performance-based Specifications

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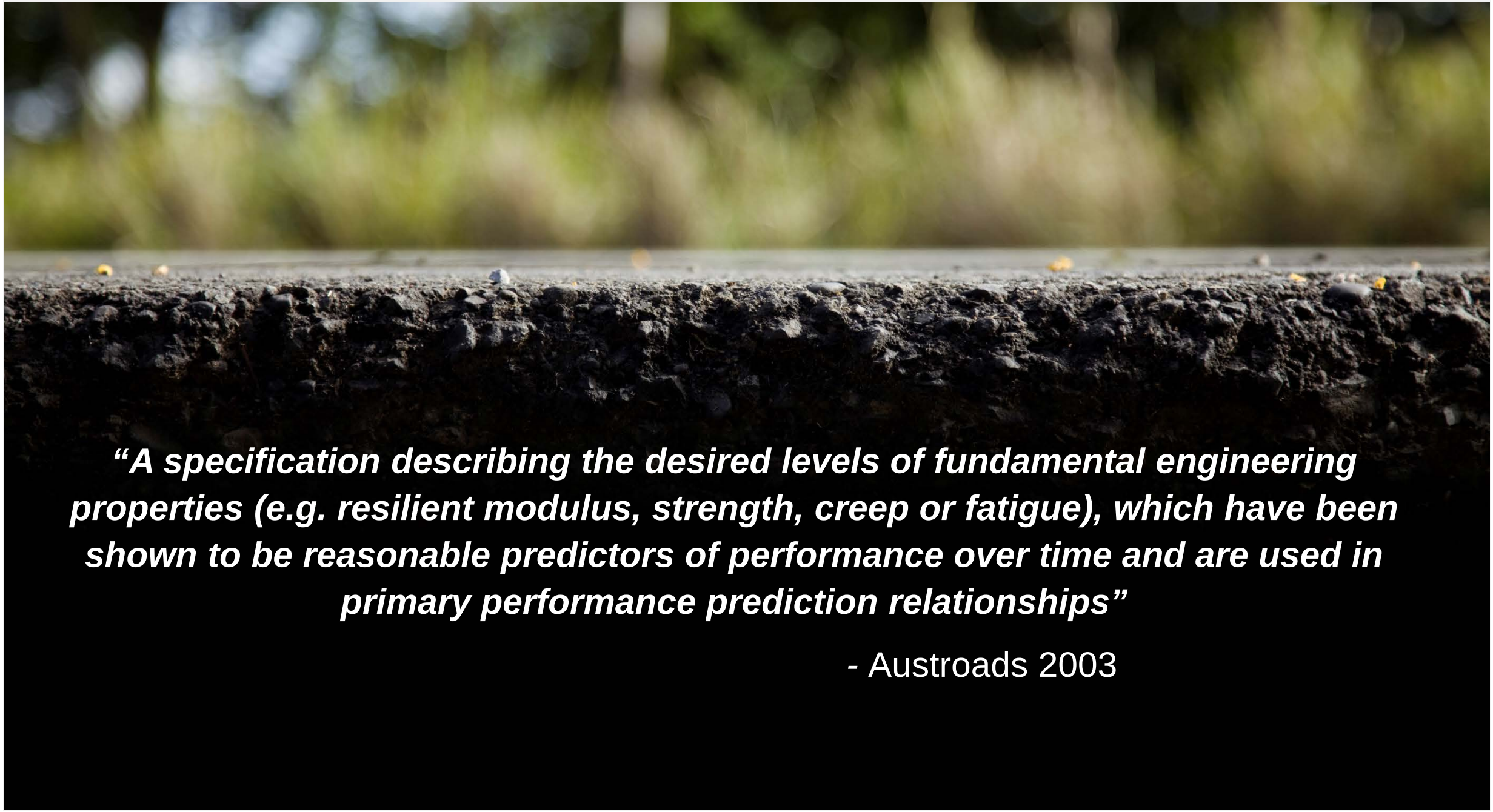

“A specification describing the desired levels of fundamental engineering properties (e.g. resilient modulus, strength, creep or fatigue), which have been shown to be reasonable predictors of performance over time and are used in primary performance prediction relationships”

- Austroads 2003

Benefits

See Section 4

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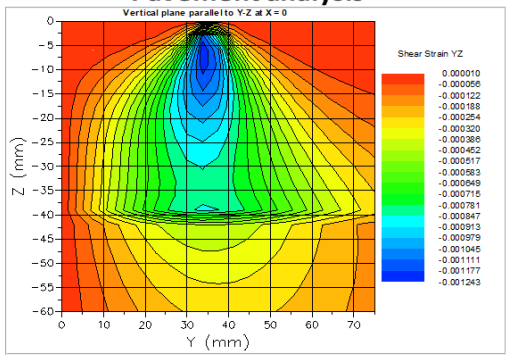
- Optimise asphalt mixes based on available materials, local environment and in-service requirements
- Facilitate the introduction of innovative technologies
- Optimal use of available materials
- Risk management
- Link mix design with structural pavement design

Guiding principles

- Harmonised specification
- Directly related to field performance
- Each agency will specify own criteria
- Only one criterion per performance parameter
- Only one test method for a specific performance parameter
- Maximise use of available equipment, where possible

Pavement analysis



Structural requirements

Property	value
E* [GPa]	> 5
Fatigue [με to 10^6]	> 300
Perm. def. [ε_p]	< 2%

Mix selection

Property	Mix 1	Mix 2	Mix 3
E* [GPa]	14	6	3
Fatigue [με to 10^6]	220	370	280
Perm. def. [ε_p]	0.8 %	1.5 %	4.2 %
Workability [voids]	5.0	4.5	5.2
Durability [TSR]	90	85	75

Tender specification

Property	value
E* [GPa]	> 5
Fatigue [με to 10^6]	> 300
Perm. def. [ε_p]	< 2%
Workability [voids]	< 6%
Durability [TSR]	> 80%

Mix design practices

International practices	Australian and New Zealand practices
• Move towards performance-based specifications • Mostly still based on volumetric requirements, but supplemented by performance testing • Main performance criteria considered are modulus, fatigue, permanent deformation and moisture sensitivity	• Reached consensus on modulus, fatigue, permanent deformation and moisture sensitivity • Well placed to implement a national harmonised performance-based asphalt specification framework

Performance criteria

See Section 4.1

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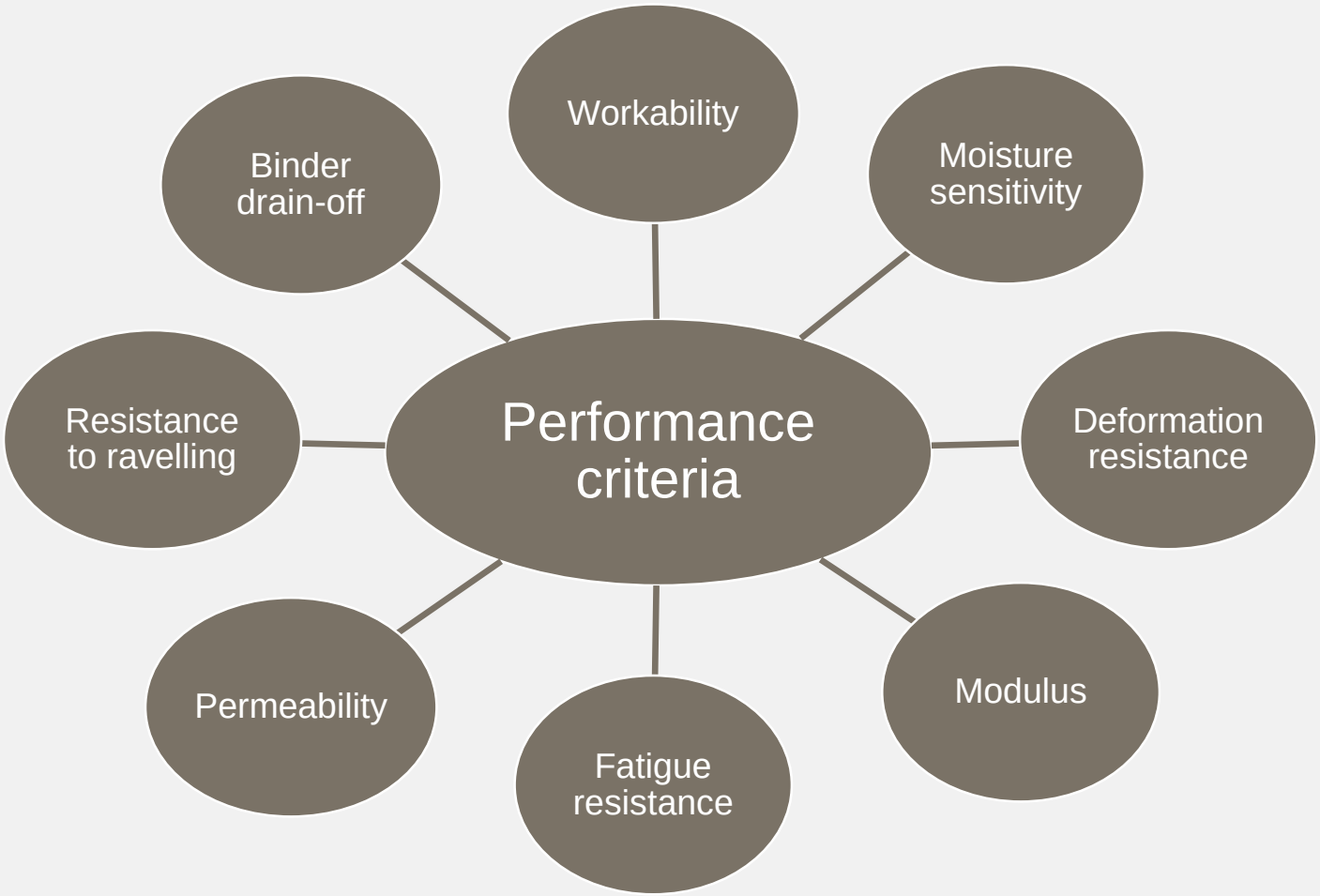

Proposed Concept Specification Framework

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Concept specification framework

See Section 4.3.3

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Property	Performance Measure	Test Method	Performance Criteria	Performance Limit
Air voids by gyratory compaction	Workability	AS/NZS 2891.2.2	Minimum and maximum air void content	Specified by road agency
Tensile strength ratio	Moisture sensitivity	AG:PT/T232	Minimum TSR value	Specified by road agency
Rut depth after 10 000 passes	Permanent deformation	AG:PT/T231	Maximum rut depth	Specified by road agency
Modulus at 50 ± 3 με	Modulus	AGPT/T274	Minimum modulus value	Specified by road agency

Concept specification framework

Property	Performance Measure	Test Method	Performance Criteria	Performance Limit
Micro strain level at 10^6 cycles to 50% of initial modulus	Fatigue	AGPT/T274	Minimum strain value	Specified by road agency
Permeability of laboratory prepared asphalt Specimens	Permeability	To be developed	Maximum permeability value	Specified by road agency
Asphalt particle loss (open-graded asphalt only)	Durability	AG:PT/T236	Maximum value	Specified by road agency
Asphalt binder drain-off (open-graded asphalt and SMA only)	Handling and durability	AG:PT/T235	Maximum value	Specified by road agency

Austroads Test Methods

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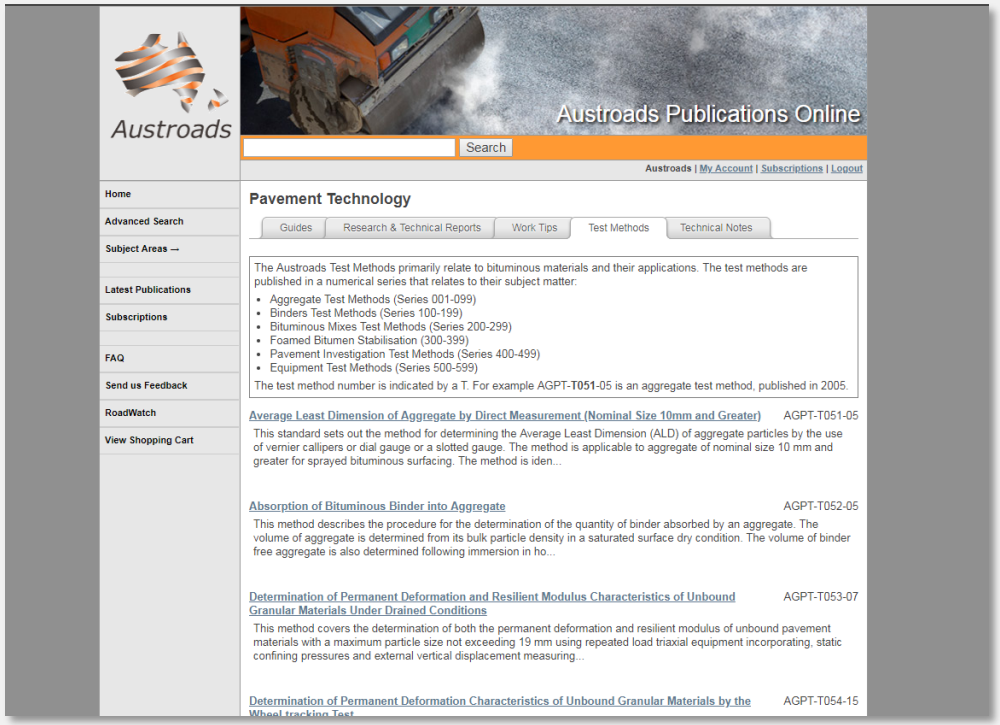

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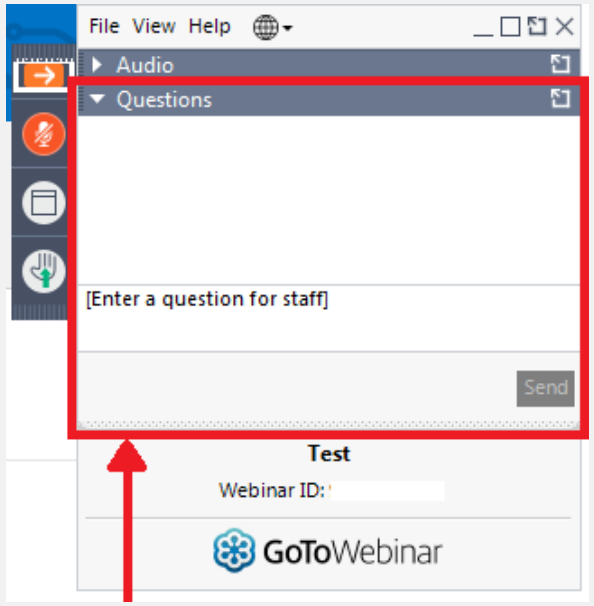

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Future Research Needs

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Key areas

See Section 5

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1. Sample preparation
2. Develop performance criteria
3. Improve link between mix design and field performance
4. Improve link between mix design and pavement design
5. Guidance on quality assurance during manufacturing and placement

Sample preparation

Sample conditioning

- Current approach simulates binder condition after approximately
  2 years in service
- Originally developed for conventional binders
- Short term ageing vs long term ageing

Source: IPC Global (2017)

Sample preparation

Compaction method

- Adopt gyratory compaction
- Slab compactor for some performance tests
- Consider load compliance requirement in test method (Gyropac vs Servopac)
- Need to link laboratory compaction to field conditions

Source: IPC Global (2017)

Performance criteria

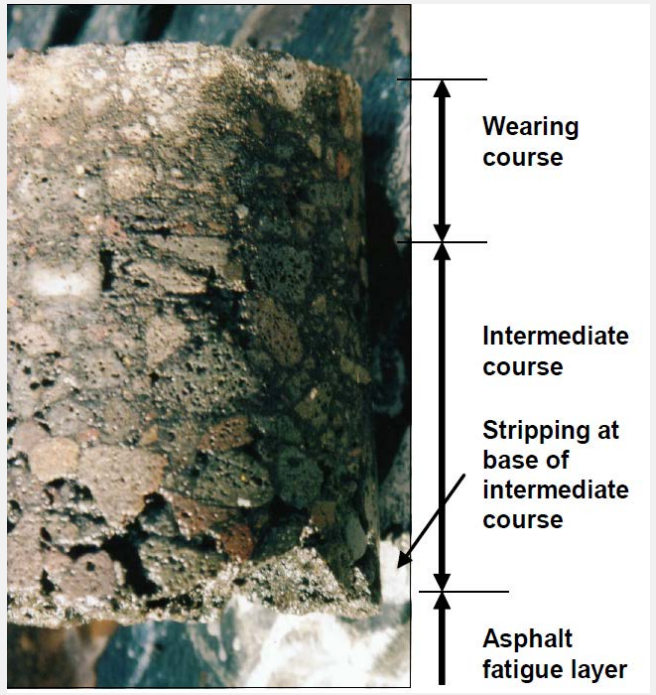
Workability (AS/NZS 2891.2.2)

- Not included in current approach
- Gyratory compaction can be used (similar to EME2 specification)
- Maximum voids – adequate workability
- Minimum voids – prevent over compaction in the field
- Need to link with field conditions
- Need to develop/harmonise test method and typical performance limits

Performance criteria

Moisture sensitivity (AGPT/T232)

- Need to link with field conditions
- Need to harmonise test method and performance criteria (i.e. requirement for freeze/thaw etc.)



Source: Australian Asphalt Pavement Association (2005)

Performance criteria

Deformation (AGPT/T231)

- Questionable link with field performance and repeatability at high temperatures
- Review test method and current performance limits first (Cooper Wheel Tracking)
- May need to investigate other devices, i.e. Hamburg Wheel Tracker or AMPT
- Need to link with field performance

Performance criteria

Permeability

- Not included in current SRA specifications
- Local test methods available (Q304A/B & RMS T655)
- Need to develop national test method and indicative performance criteria

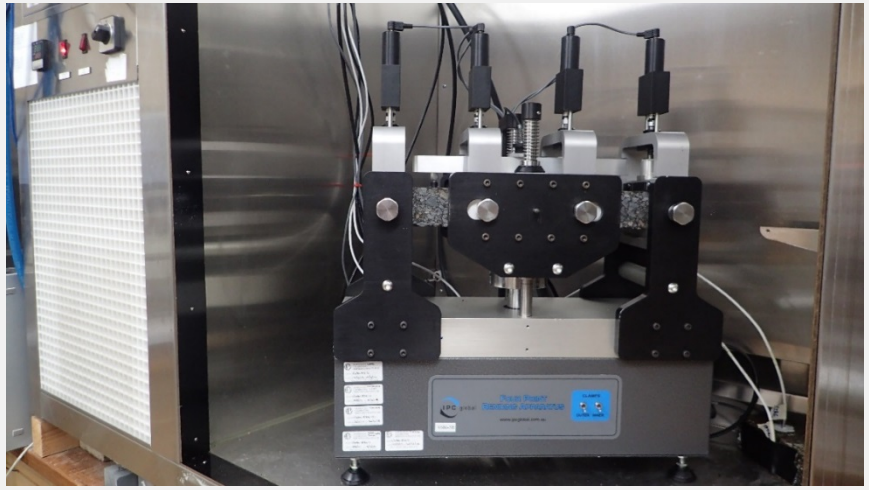
Performance criteria

Modulus – AGPT/T274

- Latest version of AGPT2 nominates flexural modulus test (AGPT/T274) for pavement design
- Need to develop performance limits for typical mixes

Fatigue – AGPT/T274

- Latest version of AGPT2 nominates flexural fatigue test (AGPT/T274) for pavement design
- Need to develop performance limits for typical mixes



Source: Wolf Paving

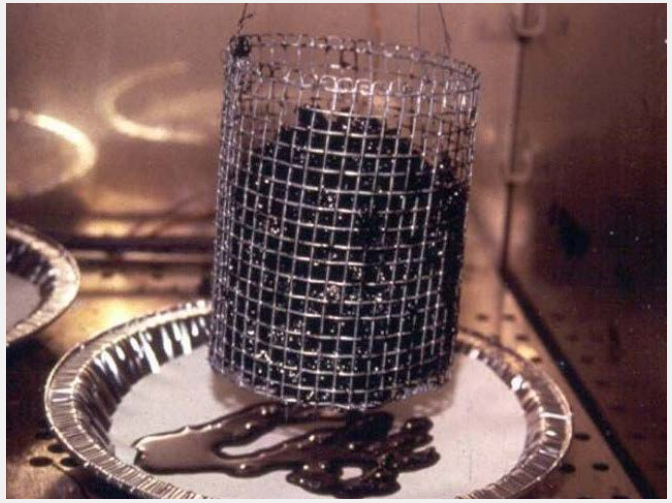
Performance criteria

Particle loss – AGPT/T236

- Open-graded asphalt only
- Already a national test method
- No further work recommended

Asphalt binder drain-off – AG:PT/T235

- Open-graded asphalt and SMA only
- Already a national test method
- No further work recommended



Proposed research framework

See Section 6

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- **Year 1** — Review sample preparation and test methods
- **Year 2** — Establish performance limits
- **Year 3** — Finalise performance limits and specification framework
- **Year 4** — Implementation and validation

Summary

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Summary

See Section 7

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- Framework will have benefits to road agencies and industry
- Australia is well placed to develop a performance-based specification framework
- Proposed specification to include requirements

Questions?

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Topic	Date
Pavement Design: Guide to Pavement Technology Parts 2 and 4C	9 March
Local Road Access for High Productivity Freight Vehicles	27 March

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