



Transport
Research

The Development of Performance Related Binder Specifications for Australia

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Australia vs Canada

	Area mil km ²	Pop'n million
Australia	7.7	18
Canada	10.0	30



Big country - Big trucks



166 tonnes

650 hp

98 wheels

Motorists get fair warning



Overview

- workshop and binder test equipment
- correlating binder properties with field performance
- summary of research work
- putting it all together

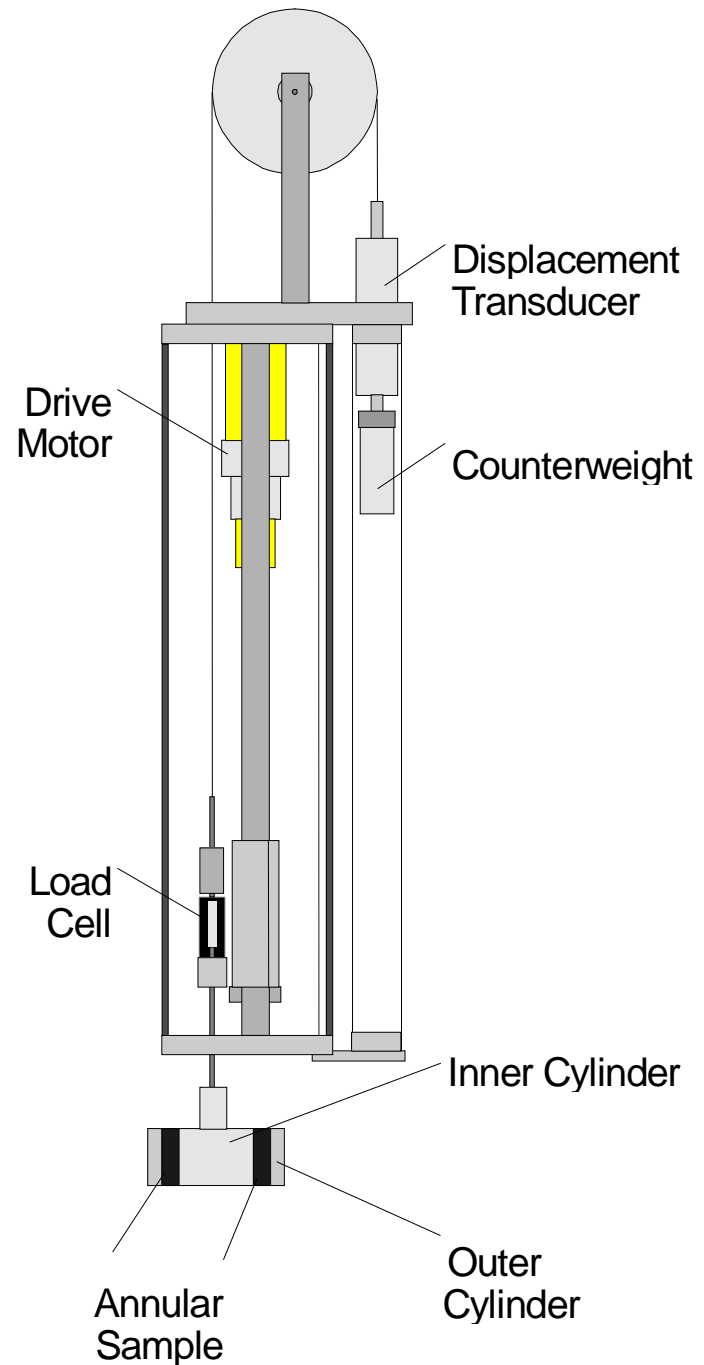
PMB Workshop

- Australian Polymer Modified Binder Workshop held in 1989
- invited participants only
- developed an Action Plan to implement findings

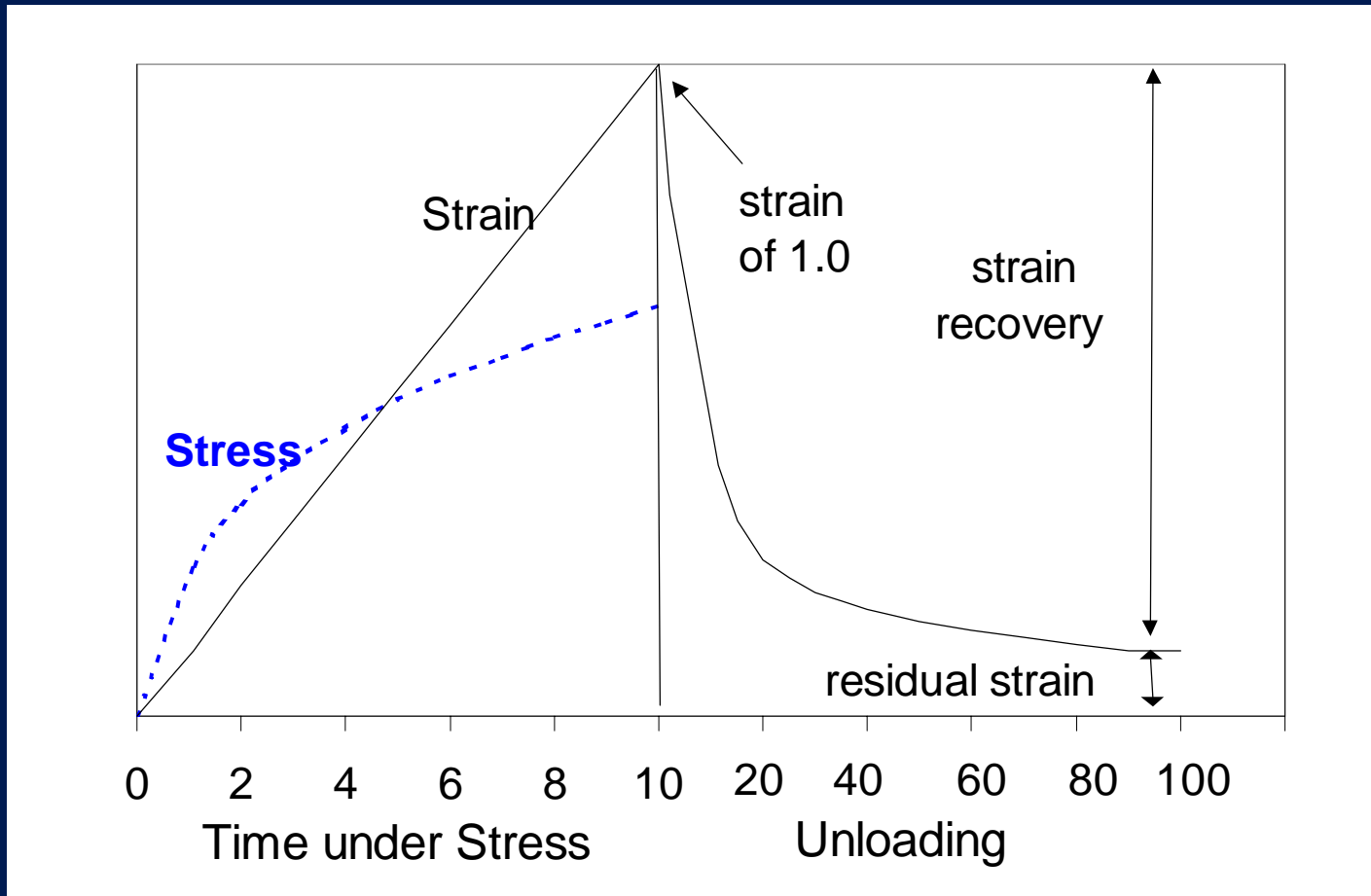
A fresh start

- we looked at test methods and specifications around the world
- none seemed designed for PMBs
- nearly all were bitumen tests modified to include PMBs
- we therefore developed our own equipment and tests

Elastometer



Elastometer output



Consistency = maximum stress/rate of strain

Plan to correlate road performance with binder properties

asphalt binders

- carry out ALF full scale trial
- then lab test asphalt slabs with wheel tracker

sealing binders

- road trials of environmentally cracked roads
- road trials of traffic cracked roads

Field performance

Australian road network

- asphalt 10% (heavily trafficked)
- seals 90% of network

key distress modes

- asphalt - rutting
- seals - cracking and stone loss

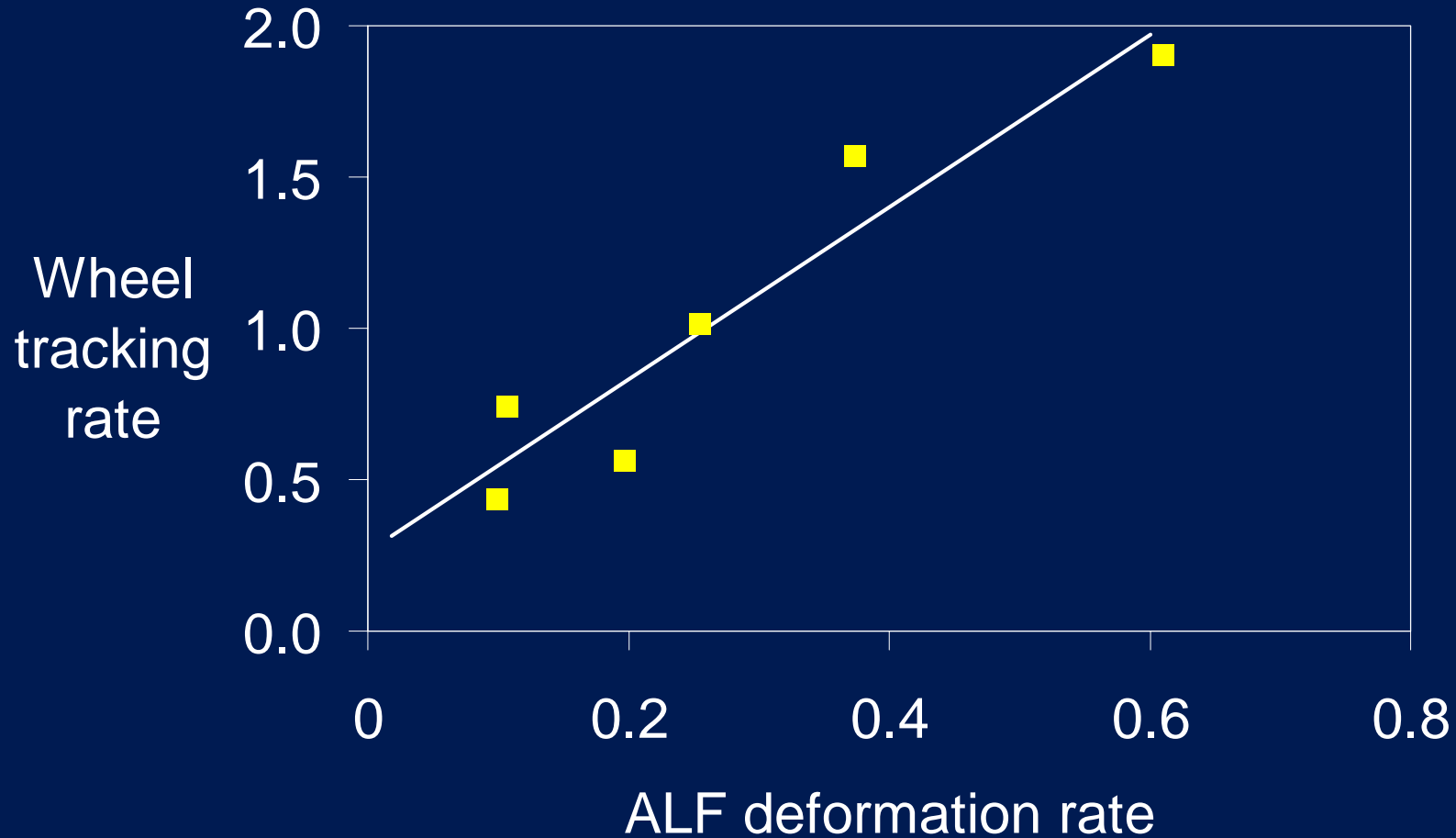
Asphalt rutting



ALF

Accelerated
Loading
Facility

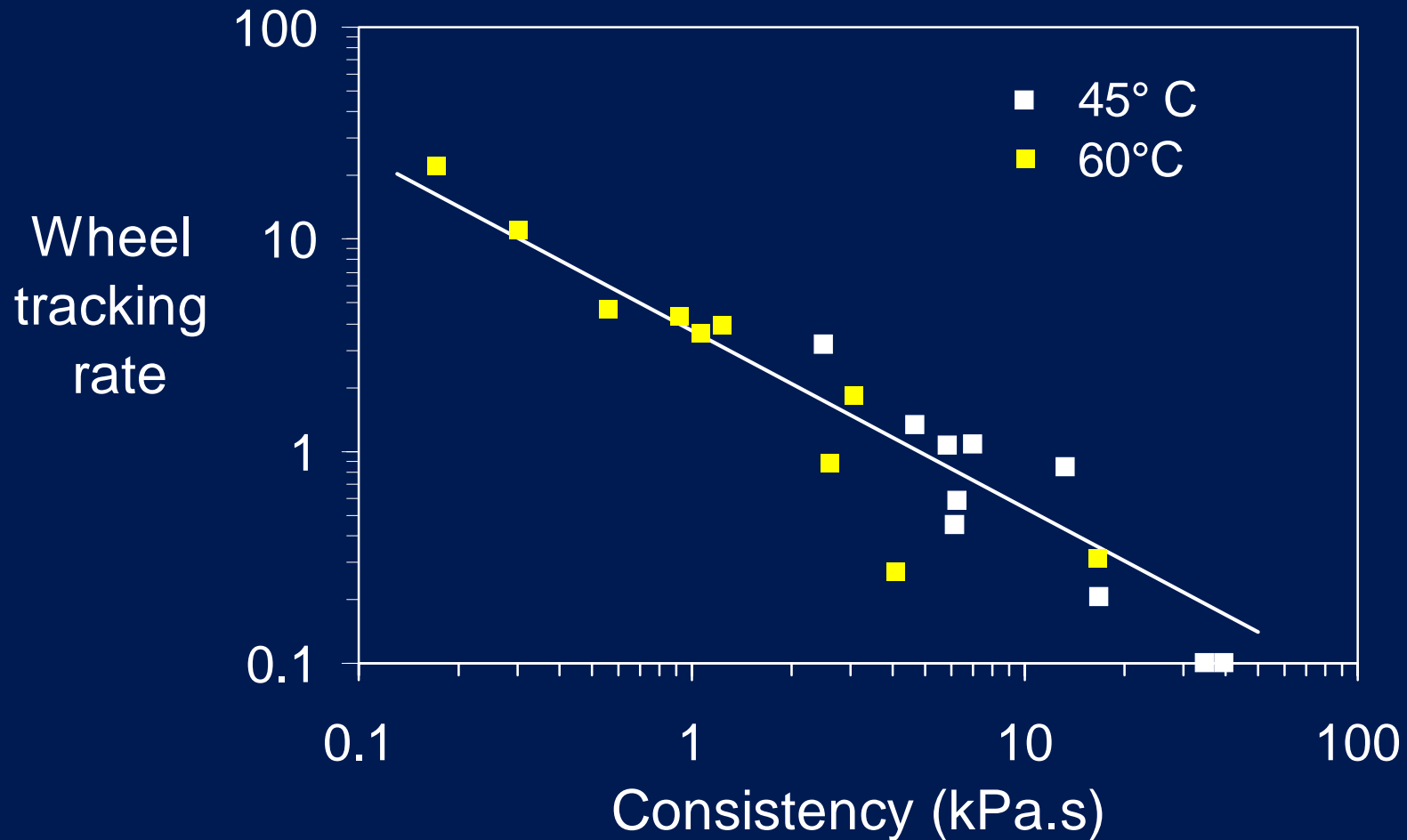
ALF vs laboratory wheel tracker



Asphalt rutting vs binder properties

- asphalt slabs made with wide range of binders
- wheel tracked at 45°C and 60°C
- binder properties measured at same temperatures
- correlations developed using combined 45°C and 60°C data sets

Wheel track rate vs Consistency



Correlations with wheel tracking rate

Binder Parameter	R ²
Elastic Recovery	0.38
G*/sin δ at 10 rad/s	0.50
Softening Point	0.65
Elastometer Consistency	0.89

Seal trial results

Range of binders used in two trials

- Western Australia trial
 - environmental cracking
 - unmodified binders best
- Queensland trial
 - traffic cracking
 - elastomeric PMBs best

Australian PMB specification

- PMBs graded on consistency
 - Elastometer at 60 °C
- low temperature test under development
 - Extensiometer toughness and tensile modulus at 4°C
- other properties used for handling and production control

Outputs from Australian work

- Guidelines for the use of PMBs
- PMB specifications
- PMB test methods, including sample preparation, handling and testing
- equipment

Binder grading property

Australia	Consistency and viscosity
Europe considering	zero shear viscosity consistency cone & plate apparent viscosity $G^*/\sin \delta$
United States	$G^*/\sin \delta$ and $G^* \cdot \sin \delta$

Putting it all together

Australian bitumen specification

- developed in 1970s
- viscosity grading at 60°C
- penetration at 25 °C
- RTFO test
- durability test

Australian Multigrade specification

- introduced in 2000
- two grades - asphalt and sealing
- viscosity at 60°C
- penetration at 25°C
- colloidal stability under development

Long term specification aims

integrated suite of specifications to include

- bitumen
- Mulitgrade
- PMBs

Integrated specification

- user will enter spec by determining use of binder or road problem (e.g. rutting)
- guidelines will give binder choice e.g.
 - asphalt Multigrade or
 - selected polymer modified binders
- second part of document will give spec values for each binder type

Extensometer

