



# *Introducing SMA to Australian Runways*

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# SMA for runways



## Acknowledgements

- Flight Lieutenant Sean (Jamo) Jamieson
  - RAAF Civil Engineer
  - Seconded to USC for 12 months
  - Master of Science (Civil Engineering)
  - This is Jamo's project
- Industry supporters



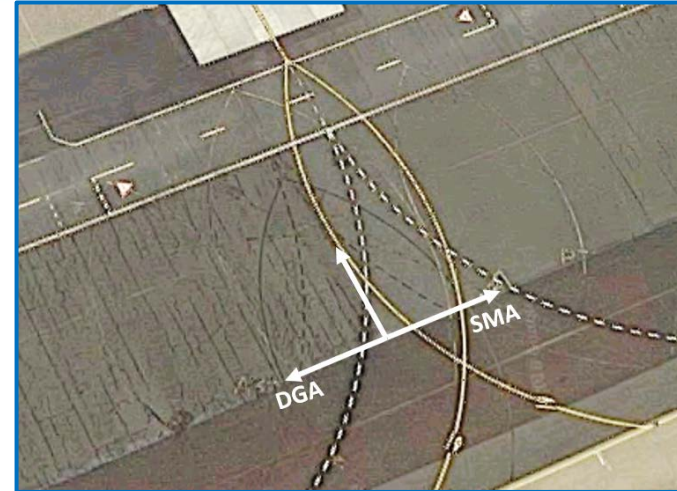
# SMA for runways

- Australia traditionally used dense graded grooved Marshall asphalt
- Grooves are 6 mm (0.25 in) by 6 mm and 32 mm (1.25 in) apart
- Minimise the impact of 'wet' conditions on skid resistance
- Just like the USA and the UK (different grooves)
- The rest of the world does not
  - BBA
  - SMA
  - OGFC
- Should Australia continue to do so?



# SMA for runways

- SMA in Australia
  - Common for roads in most States
  - Cairns International
    - 1999 10 mm and 14 mm SMA
    - Still in place on aprons
    - 2005 international apron SMA 14
  - Sydney International
    - 1999 trials on a taxiway
    - Unsuccessful - very coarse, uneven surface finish
    - Likely due to construction issues
  - No other known use on Australian airports



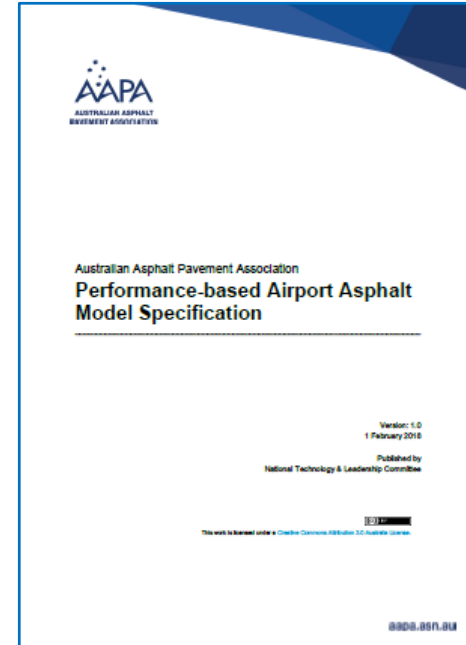


CRA 14  
DG 14

SMA 14  
BORAL  
08.98

# SMA for runways

- Performance-based airport asphalt specification
  - Developed in 2017
  - Maintains the basis of dense graded volumetrics
  - Contractor selects the binder
  - To achieve performance properties
    - Deformation
    - Fracture
    - Moisture
  - Contractor warrants performance
- Used on five runway resurfacings
- Provides a basis for alternate volumetrics/mixture types



# SMA for runways



***Shearing***



***Groove closure***



***Top-down cracking***



WASHINGTON

MONTANA

NORTH DAKOTA

MINNESOTA

OREGON

IDAHO

WYOMING

SOUTH DAKOTA

WISCONSIN

Toronto

Montreal

MAINE

NEVADA

UTAH

COLORADO

NEBRASKA

IOWA

MICHIGAN

NEW YORK

VT

NH

MA

CT

RI

United States

KANSAS

MISSOURI

ILLINOIS

INDIANA

OHIO

PENN

Philadelphia

DE

NJ

San Francisco

CALIFORNIA

Las Vegas

UTAH

KANSAS

MISSOURI

KENTUCKY

WEST VIRGINIA

VIRGINIA

Los Angeles

ARIZONA

San Diego

NEW MEXICO

OKLAHOMA

ARKANSAS

TENNESSEE

NORTH CAROLINA

SOUTH CAROLINA

Dallas

MISSISSIPPI

ALABAMA

GEORGIA

TEXAS

LOUISIANA

Houston

FLORIDA

Gulf of California

Gulf of Mexico



# SMA for runways



Statistic	USA	Australia	AU/US
Mainland area	9.1 million km <sup>2</sup>	7.7 million km <sup>2</sup>	85%
Population	325 million	25 million	8%
GDP	US\$ 19.4 trillion	US\$ 1.3 trillion	7%
Interstate length	92,000 km	16,000 km	17%
States	50	6	12%
Concrete runways	Lots	None	∞

# SMA for runways

Statistic	USA	Australia	AU/US
Mainland area	9.1 million km <sup>2</sup>	7.7 million km <sup>2</sup>	85%
<b>BITUMEN = ASPHALT (LIQUID)</b>			
<b>ASPHALT = CONCRETE (MIXTURE)</b>			
States	30	0	12.7%
Concrete runways	Lots	None	∞

# SMA for runways



X <sup>th</sup> busiest airport	USA		Australia	
	Airport	Passengers	Airport	Passengers
1	Atlanta	50,000,000	Sydney	43,000,000
3	Chicago	39,000,000	Brisbane	23,000,000
6	New York	30,000,000	Gold Coast	6,000,000
10	Charlotte	22,000,000	Darwin	2,000,000
20	Philadelphia	15,000,000	Port Headland	500,000
50	Columbus	4,000,000	Olympic Dam	74,000

# SMA for runways

- Aircraft skid resistance
  - Internationally regulated
  - International recommendations are mandated in Australia
  - All runways (regardless of size) must
    - Exceed 1 mm surface texture, or
    - Exceed minimum friction values, or
    - Groove the surface
- Dense graded
  - 0.4-0.6 mm surface texture
  - Marginal friction values
  - So the only choice is grooving



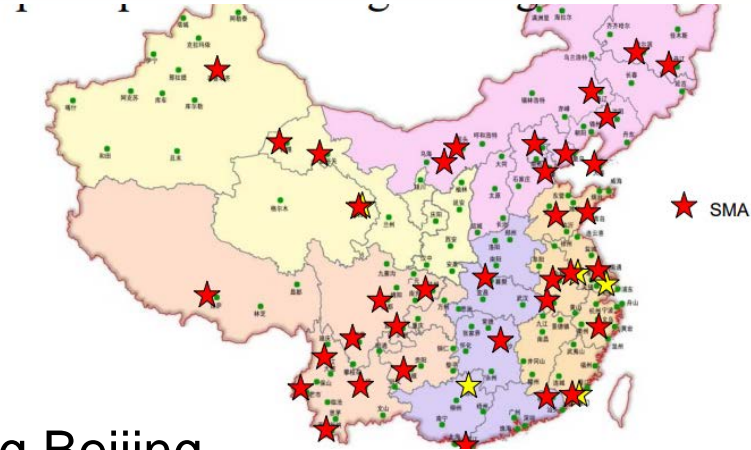
# SMA for runways

- Grooves
  - Cost \$500-800 k (in a \$6-10 M resurfacing)
  - Takes 4-6 weeks of nightly closures
  - Increase rubber build-up on touch-down
  - Complicate preservation and other maintenance
  - Grooves can close
    - Under slow moving tyres
    - Moving parallel to grooves
    - High tyre pressure
    - During hot weather
    - Can not be re-opened or re-sawn

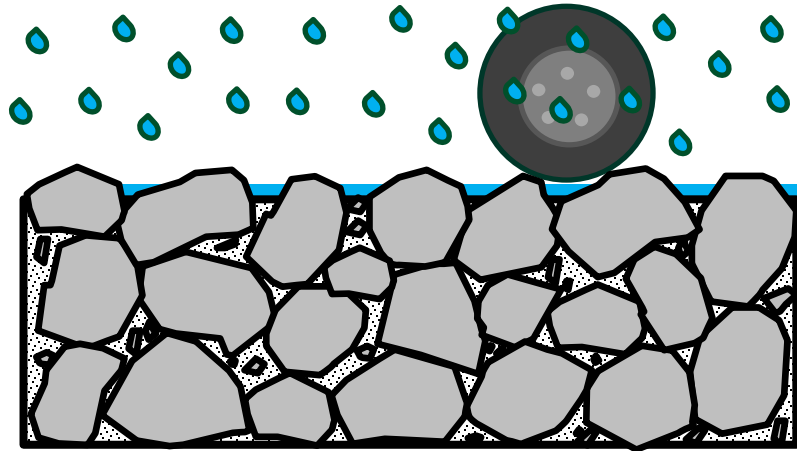
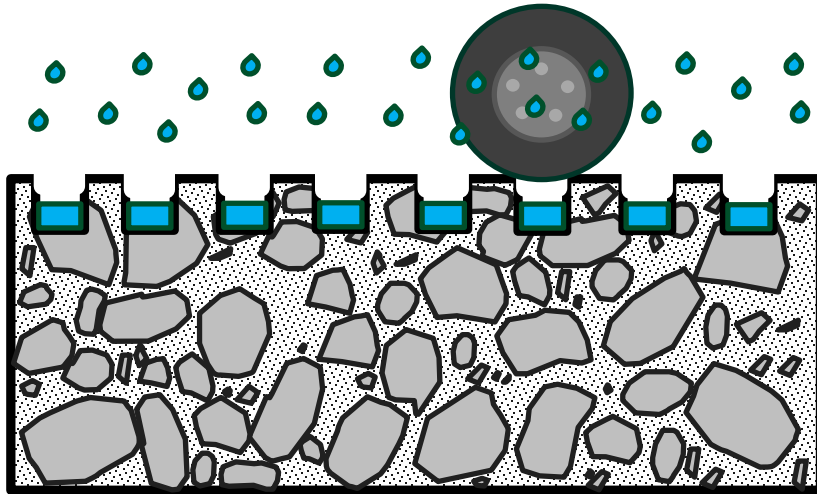


# SMA for runways

- Desire for ungrooved runways
- Other countries use them
  - Norway – SMA
  - France – BBA (gap)
  - China – SMA
  - Germany – SMA/OGFC (open)
- More than 40 runways in China, including Beijing
- But to avoid grooving it must
  - Achieve 1 mm surface texture, or
  - Achieve and maintain minimum friction



# SMA for runways



# SMA for runways

- Process for introducing SMA as an ungrooved runway surface
  - Collaborative effort
  - Based on Performance-based specification
  - Volumetric changes
  - Other associated changes
- Validation process
  - Mixtures in four labs
  - Using four different aggregate sources
  - But the same bituminous binder
  - Field trial for texture/friction measurement





# SMA for runways



Physical Requirement	Protects Against	Test
Deformation resistance	Groove closure Rutting Shearing / shoving	Copper wheel tracking (65°C and 10,000 passes)
Fracture Resistance	Top down cracking Fatigue cracking	Four-point bending (20°C and 200με)
Durability	<b>Erosion and FOD</b> Asphalt stripping	<b>Established volumetrics</b> Modified Lottman (TSR)



# SMA for runways

- Two mixtures
  - Chinese SMA 13
  - German SMA 11
- Performance tests
  - Deformation
  - Fracture
  - Moisture
- Plus
  - Cantabro losses
  - Surface texture



# SMA for runways

- Field trial
  - Taxiway at RAAF airfield near Brisbane
  - Two paver runs (joints)
  - 100 m long each (friction)
  - Scheduled for 11 November
- Outcome
  - Texture and friction
  - Heavy aircraft loading
  - Side-by-side dense graded
- Monitor over coming years



# SMA for runways

- Implementation
  - Publish
  - Promote
  - Educate
- Performance-based Specification
- Full-scale resurfacing
  - Regional airport
  - Medium airport
  - Significant airport
- Ongoing monitoring



# SMA for runways

- Other things we are working on
  - Alternates to flexural beams for concrete compliance
  - Sprayed sealing for regional airports
  - Foamed bitumen stabilisation of marginal materials
  - Non-destructive testing for strength rating
  - Accelerated asphalt aging box and test
  - Synthetic binders for asphalt
  - Reflection crack mitigation test device
  - Ravelling resistance test
  - RAP in airport asphalt
  - Recycled soft plastic for binder modification





# THANKYOU

