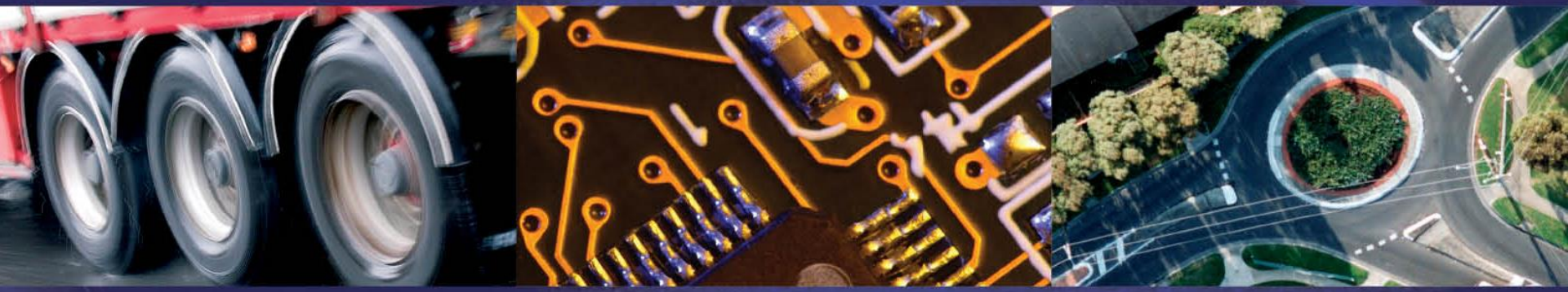

Development of Specifications and Technical Guidelines for Warm Mix Asphalt

Project Overview

- Western Australia Road Research and Innovation Program (WARRIP)
- Objective: generation/modification of specifications and technical guidance documentation to facilitate implementation of WMA by Main Roads
- Anticipated benefits:

  Environmental:

  – Lower fuel consumption

  – Lower greenhouse gas emissions

  – Reduced exposure of workers to fumes

Project Overview

Performance:

- Reduced binder aging
- More time for mixture compaction
- Improved workability and compaction

Other Anticipated Benefits:

- Longer paving season
- Reduced plant wear

Warm Mix Asphalt

- The aim of the Warm Mix Asphalt (WMA) process is to reduce the high temperatures at which traditional asphalt mixes are produced and placed without adversely affecting these properties.

- Typically, WMA is produced at temperatures that are 25-40 °C below that of Hotmix Asphalt (HMA).

- Categorized in 3 main processes
  - Using Organic additive
  - Using chemical additives
  - Direct foaming technique

Project Methodology

- Literature review
  - Related Austroads and WAPARC studies
  - National and international practices
  - Quantifiable sustainable benefits of the WMA technologies available in WA
- Review of standardised tools for comparing the sustainability of asphalt materials
- Consultation with industry (2 workshops)
- Preparation of MRWA documents (specifications and technical documents)
- Preparation of a Contract Report

Austroads Projects (TT1220, TT1454)

- Review of overseas and Australasian studies
  - emphasis on the environmental differences between WMA technology and conventional HMA technology
- Development of WMA evaluation protocol
  - provide guidance on the evaluation of specific WMA technologies and processes
- Field validation of WMA pavements
- Laboratory validation of WMA mixes
- Review of the environmental aspects of warm mix asphalt
- Review of carbon calculators

Reduction (%) in Emissions and Energy cf. HMA

	CO	CO_2	SO_2	NO_x	Energy
D'Angelo (tour of Europe)	10-30	15-40	18-35	18-70	20-35
Zeolite (foaming)	62	* no reliable data	83	30	* no reliable data
Zeolite (foaming)	19	3-18	18	6-23	23-30
water injection	10	11	* no reliable data	8	24
chemical additive	63	45	81	58	30-55
organic wax compound	32	18	* no reliable data	34	20
foam	8-29	31-35	25-30	62	24-35

Austroads WMA protocol

- Purpose: provide a guide to the evaluation of specific WMA technologies and processes
- Conduct of appropriate laboratory tests and field validation projects in order that the performance of WMA and conventional HMA can be compared
- Evaluation tool only; not a specification
- Protocol written so that, as a type of WMA is evaluated, the results can be distributed and discussed through the Austroads framework
- Expectation was that the use of the protocol would encourage road agencies to accept WMA without the need for additional testing

Components of Austroads protocol

- testing of asphalt containing additives and surfactants, both in the laboratory and during production
- testing of asphalt containing foamed bitumen (during production only)
- desirable site conditions for a field validation site
- timeframe for the evaluation
- data and information exchange

information exchange is vital if the protocol is to be successfully implemented

Austroads Field validation criteria

- WMA and ‘control’ sites should meet a number of criteria to ensure that the evaluation can be conducted as objectively as possible (length, geometry, uniformity, etc.)
- WMA and HMA sites subject to the same traffic
- Production and placement criteria as set out in protocol
  - field compaction in line with road authority requirements/specifications

Carbon Footprint

- Several carbon calculators reviewed:
  - Australia (Sustainable Aggregates SA; RTA NSW)
  - Asphalt Pavement Embodied Carbon Tool (asPECT) (UK)
  - Environmental Sustainability of Recycled and Secondary Aggregates (ESRSA, UK)
  - CO_2 Emissions Estimator Tool (UK)
  - Greenhouse Gas Calculator (NAPA, USA)
- In the absence of sufficient Australian-based emissions factors, it is premature to recommend a carbon calculation system for inclusion into the WMA evaluation protocol
- Further work needed which focuses on local data collection

Summary Austroads Projects

- Laboratory testing conducted in line with draft Protocol
  - Protocol too demanding in terms of what can be practically achieved
- Performance of WMA and HMA pavements at validation site in Melbourne excellent after 18 months
- Monitor overseas projects (e.g. NCHRP, NCAT, UCPRC) and examine outputs in terms of possible application to Australia
- Premature to recommend a carbon calculation system for inclusion in Protocol
  - need to develop data sets to allow local carbon dioxide emissions factors for the main components of road construction

WAPARC Project – Conclusions

- No perceived risks with the use of granite aggregates
- Moisture sensitivity in Sasobit®-WMA can be an issue if plant operators rush the drying of aggregates, especially in drum plants.
- Literature indicates that the performance of WMA pavements is at least equivalent to that of HMA – no immediate need for accelerated pavement test in Australia.
- Still concern regarding long-term performance: focus on moisture susceptibility, rut resistance and durability.
- Once available, outputs of NCHRP projects and relevance to Australian conditions to be reviewed.
- Risks associated with moisture require monitoring as part of QA procedures as well as moisture sensitivity testing and possibly the use of adhesion agents or hydrated lime.

WAPARC Project – Conclusions

- Potential deficiencies in rutting resistance partly addressed by choice of binder grade.
- PMBs are well suited to production using foam technology

Recent NCHRP Studies

- Project 09-47: Engineering Properties, Emissions, and Field Performance of Warm Mix Asphalt Technologies
- Project 09-47A: Properties and Performance of WMA Technologies
- Project 09-49: Performance of WMA Technologies: Stage I – Moisture Susceptibility
- Project 09-49A: Performance of WMA Technologies: Stage II – Long-Term Field Performance
- Project 09-53: Properties of Foamed Asphalt for Warm Mix Asphalt Applications

Successful Implementation in WA

- Literature review
- Review of national and international practices
- Stakeholders to understand the motivation for the use of WMA
- Technical input from asphalt producers in the preparation of specifications and technical guidelines
- Investment in changes as required by the proposed technology
- Stakeholders to commit to proposed implementation plan and innovation
- Staged approach

Suggested Workshop Discussion Topics

- Specification of WMA
  - Separate mix registration?
  - Limits on additives and water content
- WMA Technologies
  - In Australia/elsewhere and likely to be brought to WA
  - Have these technologies been extensively used and proven?
- Aim and implementation
  - Best ways to introduce it
  - Minimum reduction temperature and maximum temperature
  - Benefits for the asphalt industry
  - Logistic considerations (distance, project size, weather, etc.)

Suggested Workshop Discussion Topics

- Risks of moving to WMA
  - Moisture susceptibility/stripping, rutting durability, other?
  - Main risks for the contractor/MRWA
  - Risks of implementation with RAP
  - WMA with PMB
  - Perceived risks with the use of granite aggregates
- Management of risks
  - Additional testing to assess moisture susceptibility
  - Additional testing to assess rutting
  - Implementation of higher quantities of RAP and WMA technologies
  - Implementation of WMA in PMB mixes
  - Lower layers
  - Initially in large construction contracts in Perth and not resurfacing maintenance or small contracts