

## ISAP Working Group WG2: Meeting on Cold Recycling of RAP

11<sup>th</sup> June 2010 before EATA2010

### **Minutes:**

Prof Gabriele Tebaldi as ISAP TC representative and Secretary of EATA2010 welcomed the members of WG2 to at University of Parma, Italy and outlined the ISAP TC mandate and directives for the working groups as determined at the TRB 2010 meeting.

Prof Kim Jenkins as Chairman of ISAP WG2 gave an overview of the objectives of the meeting as outlined below. The idea is to give perspectives of different continents and countries in comparing the technologies being applied globally.

### ***Key Subjects covered in Presentation:***

- Overview of research focus areas with respected to cold recycling **of RAP** (note emphasis):
  - Laboratory
  - Field, including 1) Trials 2) APT and 3) LTPP
- Key findings emanating from research and how they feed into:
  - Mix design protocols
  - Structural design methods
  - Specifications
- Implementation of research – manuals, documentation, projects
- Cross-cutting issues to be highlighted:
  - 100% RAP (CIR) versus Granular or Gran+RAP (FDR) materials – proportion and focus in your country
  - Emulsion versus Foamed Bitumen binders
  - In place versus in plant applications
  - Active filler usage: type and application

### ***Subjects to be discussed in Meeting:***

- Barriers to Cold Recycling
- Is current research addressing the relevant areas of cold recycling that need attention?
- Mechanisms of distress being designed for (permanent deformation, fatigue, durability)?
- Identification of key areas for further research
- Harmonisation of global mix design and structural design methods?
- Cooperation between universities/countries?
- Way forward to WG2:
  - TRB annual meeting
  - Conferences to arrange workshops in next 12 months

Other forms of communication/cooperation

### ***USA perspective: Presented by Dr Dave Jones***

- In the USA there are notable differences between states, so it is very difficult to give a holistic, homogenous view of the USA perspective of cold recycling. For this reason, mainly the Californian experiences are focussed upon.
- Generally documents such as ARRA and BARM recycling manuals provide some guidance on cold recycling technology in the USA but do not provide detailed protocols for mix design and pavement design
- External issues such as drainage are a very important consideration in the design approach using cold recycling technology
- Construction QC issues are very important including aggregate mixing temperature, compaction moisture considerations etc etc
- *Laboratory studies:*
  - RAP percentage and type are being investigated as an important consideration in the behaviour of cold recycled materials
  - Quality control of laboratory testing is very important e.g. where and how temperature is monitored e.g. thermocouples, and should not be underestimated. After all, these materials are visco-elastic and their properties are temperature and time dependent.
  - ITS testing is useful for cold recycled material evaluation provided that sufficient replicas are tested
  - Types of failure in ITS specimens have been analysed and modelled i.e. adhesive versus cohesive failure of these mixes
- *Publications:*
  - Research reports are available on the UC Davis PRC website
  - Project specifications have been developed for cold recycled materials
- *Implementation:*
  - Typical mixes include about 3% foamed bitumen and 1.5% cement
  - Aggregate requirements include 5 to 10% passing 0.075mm sieve
  - Mix design ITS tests are based on ITS<sub>wet</sub> condition only (ITS<sub>dry</sub> is not considered necessary)

### ***European perspective: Presented by Dr Jean-Pierre Serfass***

- Currently in France about 50% of RAP is consumed in hot recycling (using some of the 380 HMA plants in the country)
- WMA technology is growing fast
- Cold recycling technology has developed slowly mainly because
  - Guidelines for cold recycling are not well formulated
  - Foamed bitumen and cement combinations have not received general acceptance
- Experimental sections have been identified in 4 climatic regions in France, for evaluation
- The research sections are aimed at reconciling laboratory and field behaviour of these materials

- Laboratory curing procedures in France use temperature and relative humidity criteria
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- Application of cold recycling technology will increase in future because of :
  - The focus on sustainable materials globally
  - Expected reduction in the number of HMA plants
- Recent research projects have focussed on recycling of 100% RAP
- GHG and LCC analysis related to cold recycling technology is being considered more and more using e.g. USIRF and LCPC software

### ***South African and Southern Hemisphere perspective: Presented by Prof Kim Jenkins***

- The materials are being defined as BSMs (bitumen stabilised materials) to highlight their differences to HMA. BSMs are non-continuously bound and are designed for permanent deformation. HMA has bitumen in continuum and is designed for fatigue and permanent deformation
- BSMs provide an equal footing for foamed bitumen and emulsion binders
- Active filler is generally restricted to 1% cement or less (or sometimes lime)
- Binder contents are typically 2% to 3% residual bitumen binder
- New classification, mix design and pavement design methods have been developed and published by the Asphalt Academy in South Africa, in TG2 Technical Guideline

### ***Meeting Discussions***

- ***Fatigue:*** It is very difficult to carry out these tests on cold recycled mixes, even with 3 to 5% binder contents, but especially at lower binder contents
- ***Area for research:*** Influence of RAP % , degree of ageing of RAP binder, use of rejuvenators, thermal conductivity etc on material behaviour
- Malaysia discussed the development of specifications on cold recycling technology in that country over the past 15 years.
- ***Durability:*** Better ways of simulating durability issues and testing them needs attention, including the influence of curing on moisture resistance for these mixes
- ***Mixing moisture content (full-scale) and foam characteristics:*** The influence of these factors on mix behaviour needs further investigation
- ***Energy;*** Methods of analysis of energy consumption and GHG emissions need investigation and harmonisation. This requires a link to Prof John Harvey's WG4 on LCC

### ***Key Decisions taken by WG2 Members***

- WG2's focus on Cold Recycling of RAP should not only include 100% RAP mixes, but rather blends of RAP and other materials too e.g. granular and recycled cemented materials

- Active fillers should be incorporated into the mixes being considered but there needs to be one of two components present in the mix for it to be eligible for consideration by WG2;
  - The presence of RAP in the mix
  - The presence of emulsion for foamed bitumen as binder in the mix
- Roads in developing areas e.g. with weathered gravels or sand blends would be considered by WG2 provided that emulsion for foamed bitumen binder was used as a stabiliser

### ***Way Forward***

Four areas of synthesis of global research and publications on cold recycling technology were identified:

<b>Focus Area</b>	<b>Task Group Leader</b>
1. Research on cold recycled materials	Dr Dave Jones
2. Mix Design Procedures	Prof Kim Jenkins
3. Structural Design	Dr Fenella Long and ?
4. Construction, QC and Specifications	Mr Dave Collings

- These Task Group Leaders will communicate with other WG2 members and begin to develop a synthesis of publications, reports and other documented information in these focus areas
- Malaysian Roads Conference in October 2010 will be used to have a regional Cold Recycling Workshop for South-East Asia that can feed into ISAP WG2
- TRB 2011 in Washington, USA: A brief meeting of WG2 will be arranged to discuss progress
- CAPSA 2011 in September, Durban, South Africa: Detailed feedback will be made at a workshop to be held linked to this conference
- Fortaleza, Brazil 2012: Inputs from South American researchers. Final feedback and launch of a Synthesis “State-of-the-Art” report on Cold Recycling of RAP i.e. the work of ISAP WG2. This will be a working document that can be updated in future years when more input information becomes available.
- In addition, Professor Hervé Di Bennideto will be approached by Professor Gabriele Tebaldi to propose a special issue for IJRMPD on Cold Recycling of RAP.

### ***Afternoon Workshop***

In the afternoon session several presentations were made covering:

- Italian perspective: by Dr Andrea Grilli of University of Ancona, Italy
- Chinese perspective: by Professor Peiwen Hao of Chang’An Univeristy, Xi’an, China
- Construction Issues: by Mr Dave Collings, of Loudon International, South Africa

These presentations will be made available on the ISAP TC website