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Course Content


- Structural Design
- Materials
- Construction
- Inspection Guide
- Summary
- Assessment of Learning (Jeopardy)
- Course Evaluation



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History of Asphalt Rubber


- Used since the 1960's
- Used in chip seals, inter-layers, and hot mix asphalt
- Used extensively in Arizona, California, Florida and Texas
- Design and construction guides now available from some agencies



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History of Asphalt Rubber (Cont.)


- Applications
 - Asphalt rubber chip seals and interlayers
 - Overlays and wearing courses
- Performance
 - Variable results in early years
 - Most effective in retarding reflection cracking as a thin surface layer
 - Mixes perform satisfactorily if properly designed and constructed



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Caltrans Experience with RAC


- 1970's – Used for chip seals and hot mix
- 1983 – Ravensdale project - reduced thickness
- 1992 – "Design Guide for ARHM-GG"
- 1995 – Over 100 RAC projects constructed
- 2001 – Over 210 RAC projects constructed
- 2003 – CIWMB/Caltrans partnership
- 2005 – AB338 mandates increased RAC use (20% AC in 2007 to 35% in 2013)



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Caltrans Use of RAC


- Largest Use
 - Thin overlays (RAC-G)
 - Mitigate reflective cracking
 - Reduced thickness
- Other Uses
 - Friction course (RAC-O)
 - Durable sacrificial course (RAC-O-HB)
- Performance
 - Successful in all applications
 - Problems generally due to construction issues

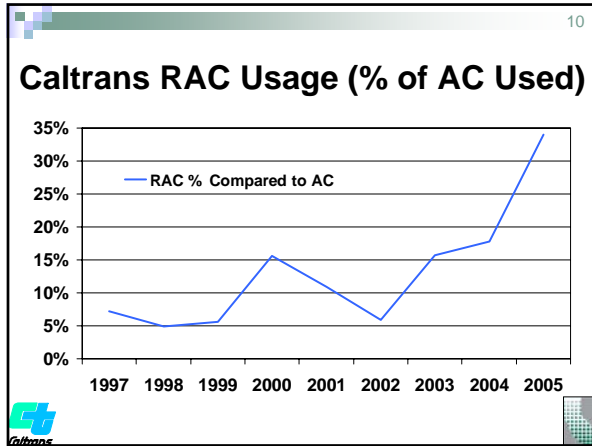


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Tires Used in RAC

Year	Number of Tires Used in RAC
1997	914,700
1998	913,400
1999	1,143,000
2000	3,967,900
2001	1,733,300
2002	703,900
2003	1,126,500
2004	1,788,900
Total	12,291,800







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- ### Caltrans Research with RAC Products
- 1999 – HVS confirmed “ $1/2$ - thickness”
 - 2003 – HVS on 8 field constructed overlays (6 Test Sections)
 - 2004 – Fre-33 (9 Test Sections)
 - 2005 – Men-20 (4 Test Sections)
 - 2005 – SJ-5 and Ker-99 (rubberized bonded wearing course, RBWC)
- Caltrans



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Caltrans Challenges with RAC



- 1997 – 00: 10 pilot projects using MB
- 2002 – 04: Five RAC (5-year warranty) projects throughout the State
- 2004 – 05: Full-scale field experiments



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MB and HVS

- 10 pilot projects using RMB (1997 - 2000)
- Performance: 8 good, 1 fair*, and 1 poor*
- HVS Sites – UC Berkeley
 - 45 mm RAC-G, Field Blend
 - 45 mm Type G (MB), TB
 - 90 mm Type G (MB), TB
 - 45 mm MB 15%, TB
 - 90 mm MB 15%, Term. Blend
 - 90 mm DGAC Type A (Control)
- HVS Performance: Exceeding expectations




* Not materials related

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RAC 5-Year Warranty Projects

- 5 Projects Constructed in 2002 - 04
 - 4 – Wet Process (Fre-33, Ven-150, Mer-140, SD-75)
 - 1 – MB-D (terminal) (Las-395)
- Level Playing Field
 - 15% CRM
 - Open specifications
 - 5-Year Performance Warranty Criteria
 - > Rutting > Cracking > Delamination
 - > Bleeding > Potholing
- Regular Review and Evaluation




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Fre-33 and Men-20 Projects

- Fre-33 (Firebaugh, 9 test sections, June 04)
 - DGAC (90 mm)
 - RAC-G (45 mm, 90 mm)
 - RUMAC (45 mm, 90 mm)
 - MB-G (45 mm, 90 mm)
 - MB-D (45 mm, 90 mm)
- Men-20 (Dist. 1, 4 test sections, August 05)
 - DGAC (105 mm)
 - RAC-G (60 mm)
 - RUMAC (60 mm)
 - MB-D (60 mm)


- Performance evaluation sections
- Laboratory performance tests
- Comparison to HVS



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Advantages of AR

- Good durability – in terms of resistance to cracking and aging
- Environmental friendly – make value-added use of a waste material, reduce traffic noise
- Versatility – can be used in most maintenance and rehabilitation activities, often at reduced thickness for resistance to reflective cracking
- Longer lasting color – for better contrast with striping and marking
- Reduced maintenance – for both chip seals and hot mix




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Primary References

- [Asphalt Rubber Usage Guide](#)
- [Use of Scrap Tire Rubber – State of the Technology and Best Practices](#)
- [Synthesis of Caltrans Rubberized Asphalt Concrete Projects](#)
- [Feasibility of Recycling Rubber-Modified Paving Materials](#)
- [Study on Structural Design Considerations](#)
- [Flexible Pavement Rehabilitation Manual](#)
- [Asphalt Rubber Design and Construction Guidelines](#)
- RAC-G SSP Version (12-12-05)
- RAC-O SSP Version (12-12-05)

http://www.dot.ca.gov/hq/esc/Translab/pmlab/CALTRANS_CIWMBPROJECTT021DELIVERABLES.htm



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Summary of Module 1

- Course Objectives and Content
- History of RAC
- Caltrans Experience with RAC
- Advantages of RAC
- References

