



VI International Congress Valorisation and Recycling of Industrial Waste

WHEN THE RUBBER MEETS THE ROAD



PHD INES ANTUNES
DR DOUG CARLSON



Rubber Pavements Association



VI International Congress Valorisation and Recycling of Industrial Waste

**Il Bitume Modificato con
Polverino di Gomma di
Pneumatico Riciclato**



Asphalt Rubber Italia

La gomma si fa strada. Ottima.



✓ **Exclusive producer of Asphalt Rubber
in Italy**

**Project, innovative solutions and
complete technical support**

www.bitem.it



VI International Congress Valorisation and Recycling of Industrial Waste

Our Mission Statement

Dedicated to encouraging greater usage of high quality, cost effective asphalt pavements containing recycled tire rubber.

RPA is a non-profit industry association

Technology transfer through many initiatives



Rubber Pavements Association

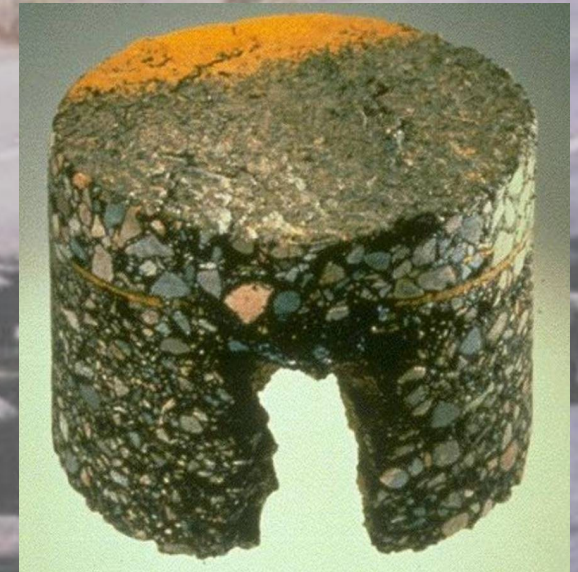
www.rubberpavements.org

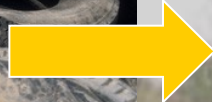
Asphalt Rubber

40 years of experience



- ✓ Reduced oxidation
- ✓ Higher resistance to fatigue
- ✓ Smaller thicknesses
- ✓ Lower construction times
- ✓ Higher safety (high friction)
- ✓ Lower noise
- ✓ Saves natural resources and costs
- ✓ Lower maintenance costs





Crumb Rubber Process





Adrian Meridors/The Bee



**2000 Recycled Tires
per Km on a typical 5 cm overlay**



“Asphalt Rubber”

is a blend of asphalt cement, reclaimed tire rubber and certain additives, in which the rubber component is at **least 15%** by weight of the total blend and has reacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles.

ASTM D6114

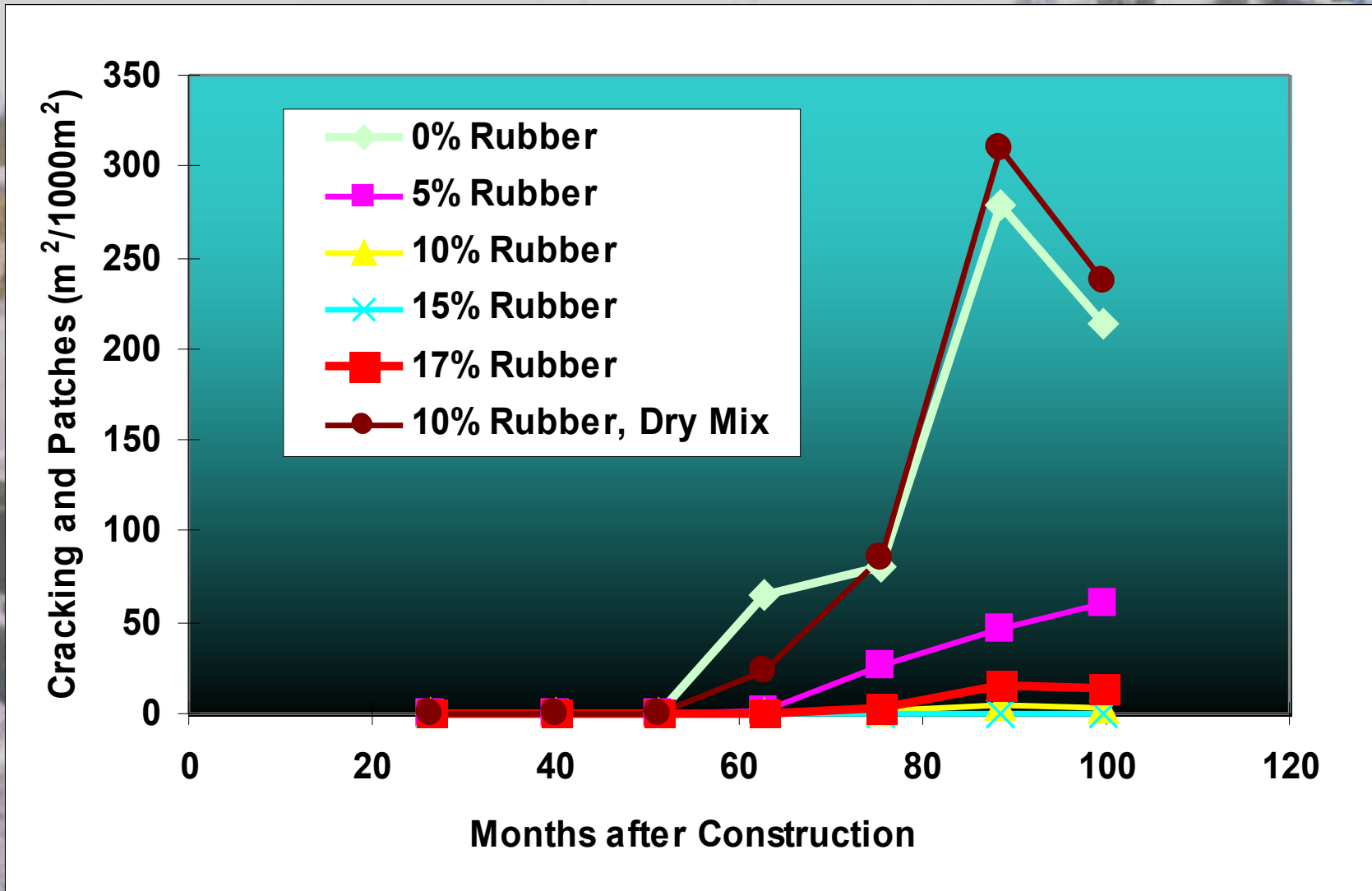
- Process in public domain – not patented
- Initially Mac Dowell had a patent
- Exists for 40 years



“Asphalt Rubber”

- ↓ Wet Method (less than 15%)
- ↓ Wet Method (10%) - Terminal Blend
- ↓ Wet Method (5% + SBS) - Terminal Blend
- ↓ Wet Method (3.5%) - Terminal Blend
- ↓ Dry Method (1, 2, 3%) of aggregate weight - Short and Long Reaction times
- ↓ Proprietary Methods (no technical info!)
- ✓ **Wet Method (with 18-22%)**

Modified Binder 20 +/- 2 % CRM Specification ASTM D6114



Italian Asphalt Rubber



- Uses **20 +/- 2 % crumb rubber**
- Crumb rubber gradation passes **#10**
- Rubber and asphalt mixed together hot to form a modified binder
- Binder pumped into plant and mixed with aggregate
- **Hot mix paved as normal**

Italian Asphalt Rubber



Summer 2006

**2000 Ton of GAP graded
500 Ton of OPEN graded**

Several jobs in TOSCANA



Advantages

Fatigue Cracking

IRI

Longitudinal Cracking

Low Temperature

Rutting

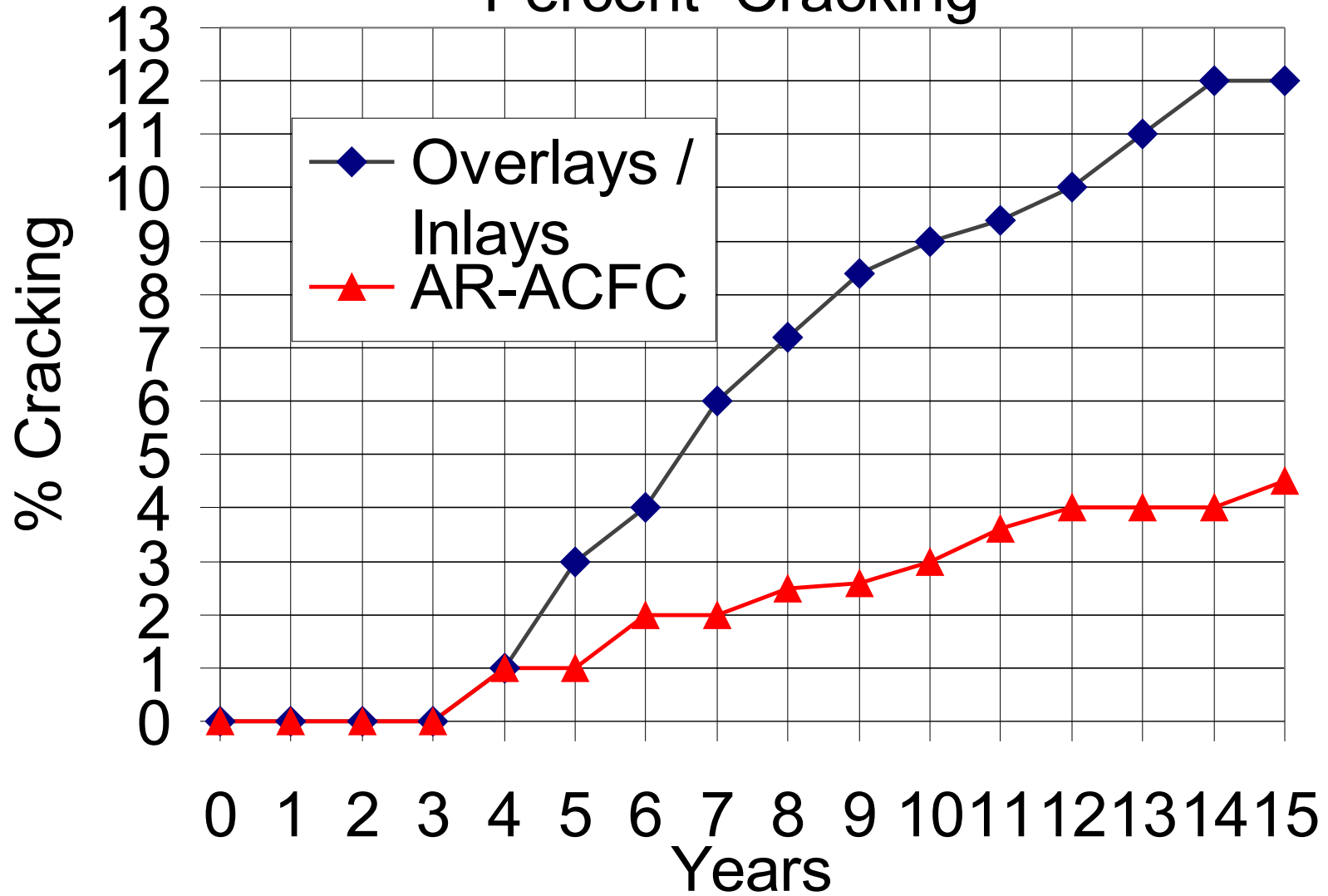
To solve problems



Cracking



Percent Cracking





Asphalt Rubber

“Can undergo about **five** times the strain before rupture than can asphalt”

*1977 ADOT Research Report
By Green and Tolonen*

Film Thickness

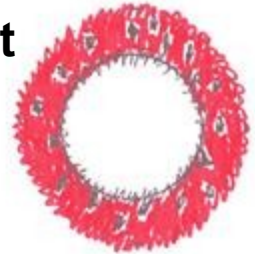
**Dense Graded
HMA
9 Micron**

5 % Bitume



**Gap Graded
Asphalt Rubber
18 Micron**

**7.5 % Asphalt
Rubber**



**Open Graded
Asphalt Rubber
36 Micron**

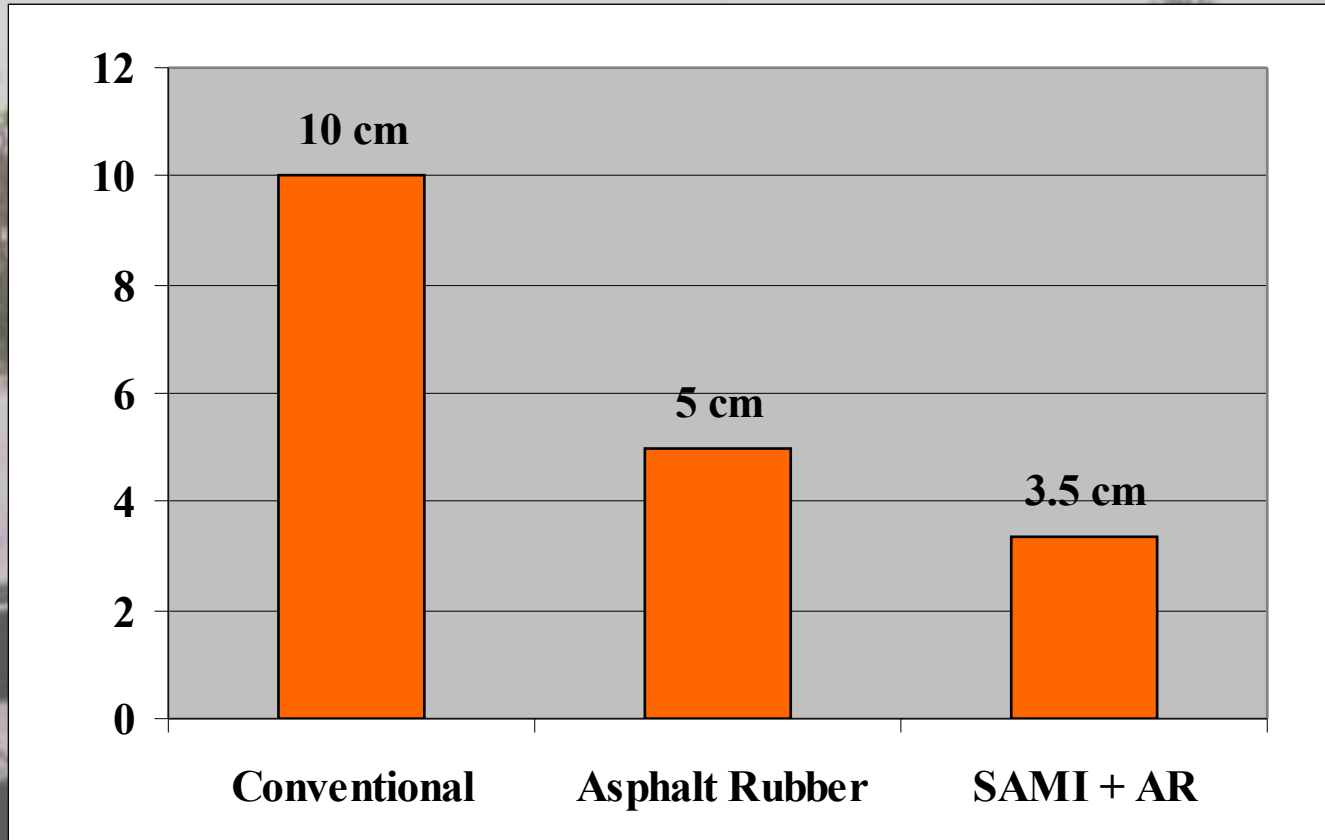
**9.0 % Asphalt
Rubber**



CALTRANS

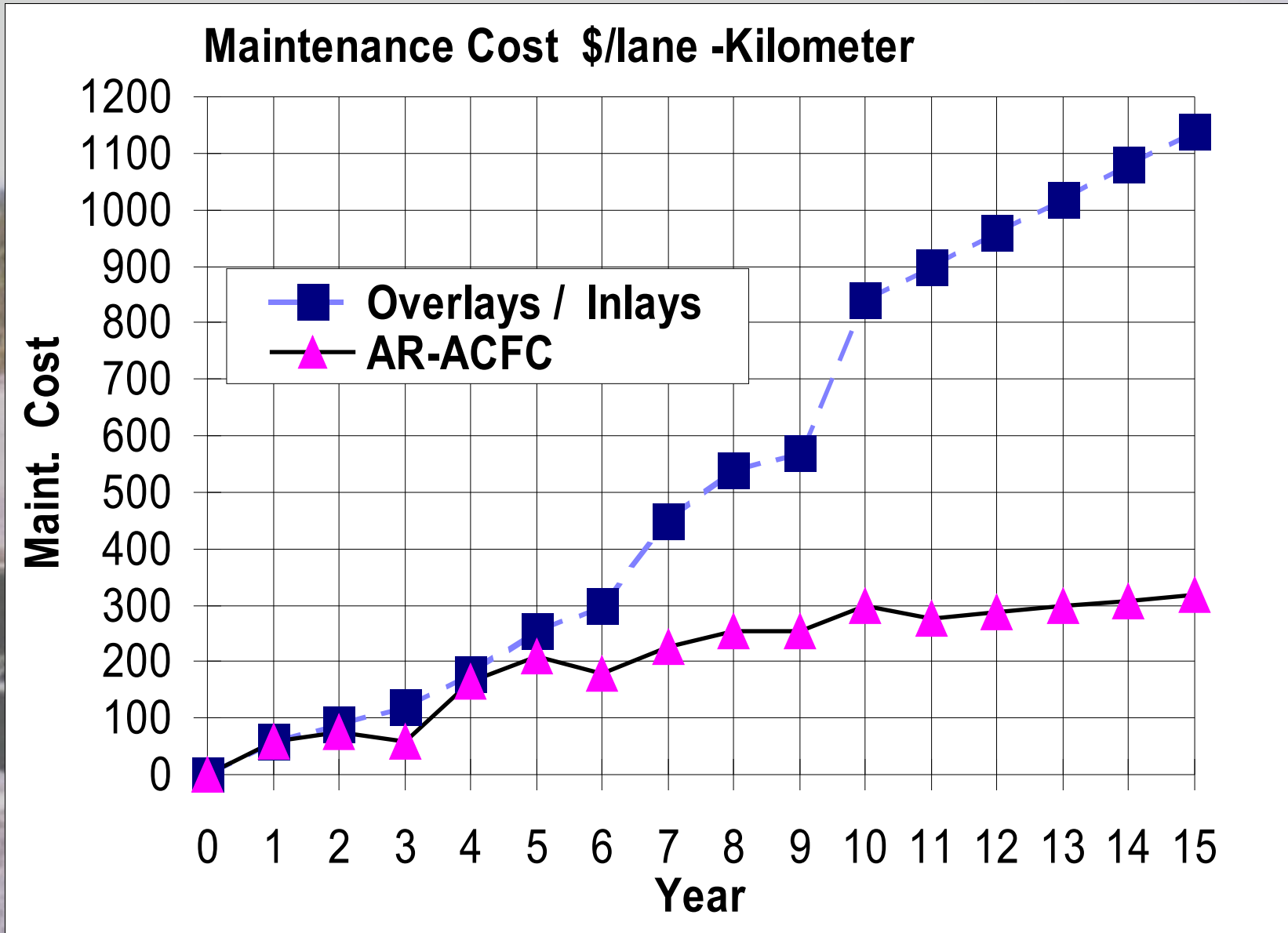


Recomendations for Thickness Reduction



- Up to **50% thickness reduction** when compared with conventional mixes
- Approved by FHWA, CSIR and UCB

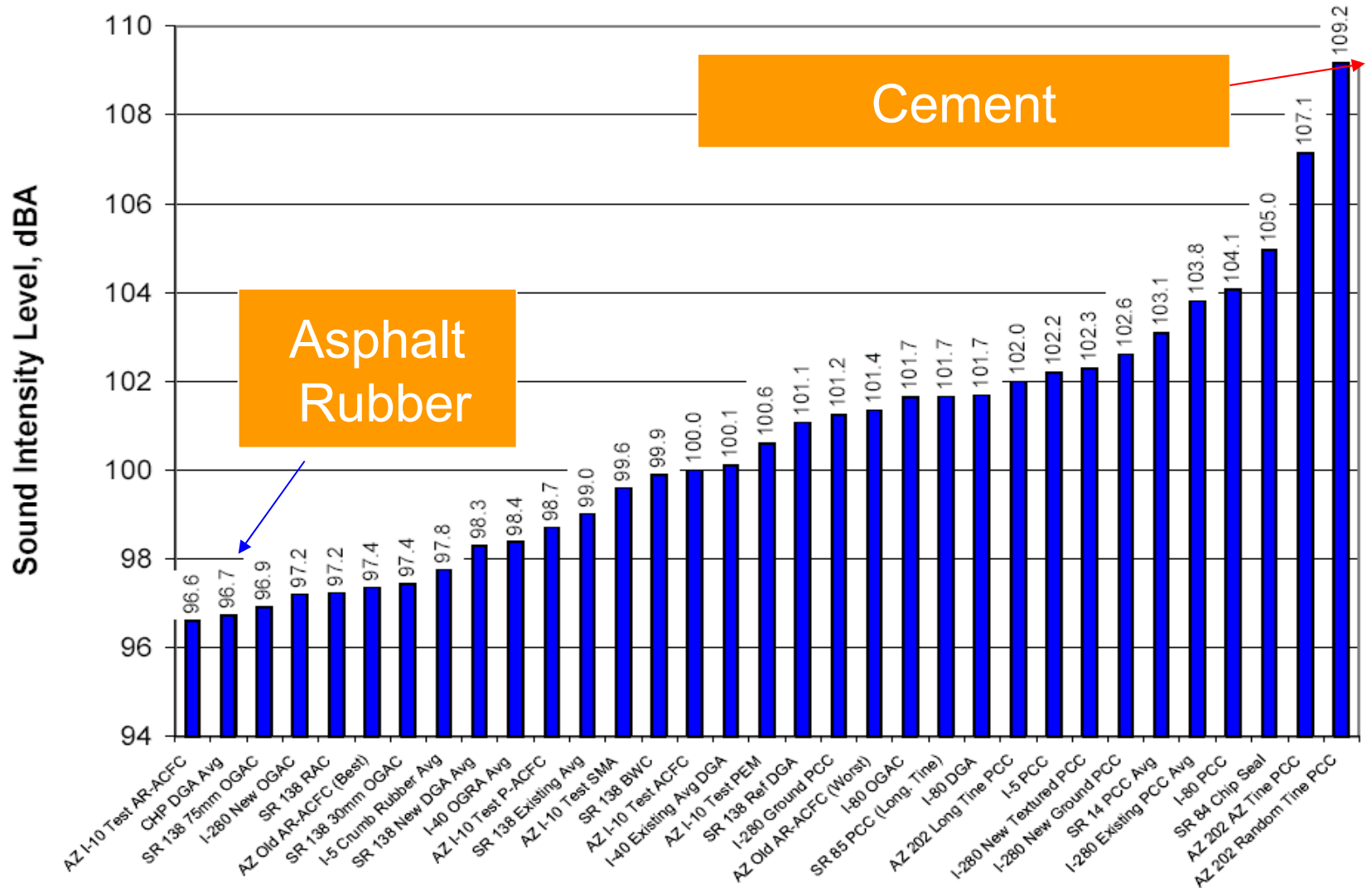
Maintenance



Noise reduction



Tire/Pavement Noise Sound Intensity
California & Arizona Highways





Noise reduction

Location	Before	After	Decrease
Shoulder (15m)	79.8	72.6	7.2
Soundwall (30m)	76.6	67.1	9.5
Residential (120m)	51.7	45.6	6.1

Improves security



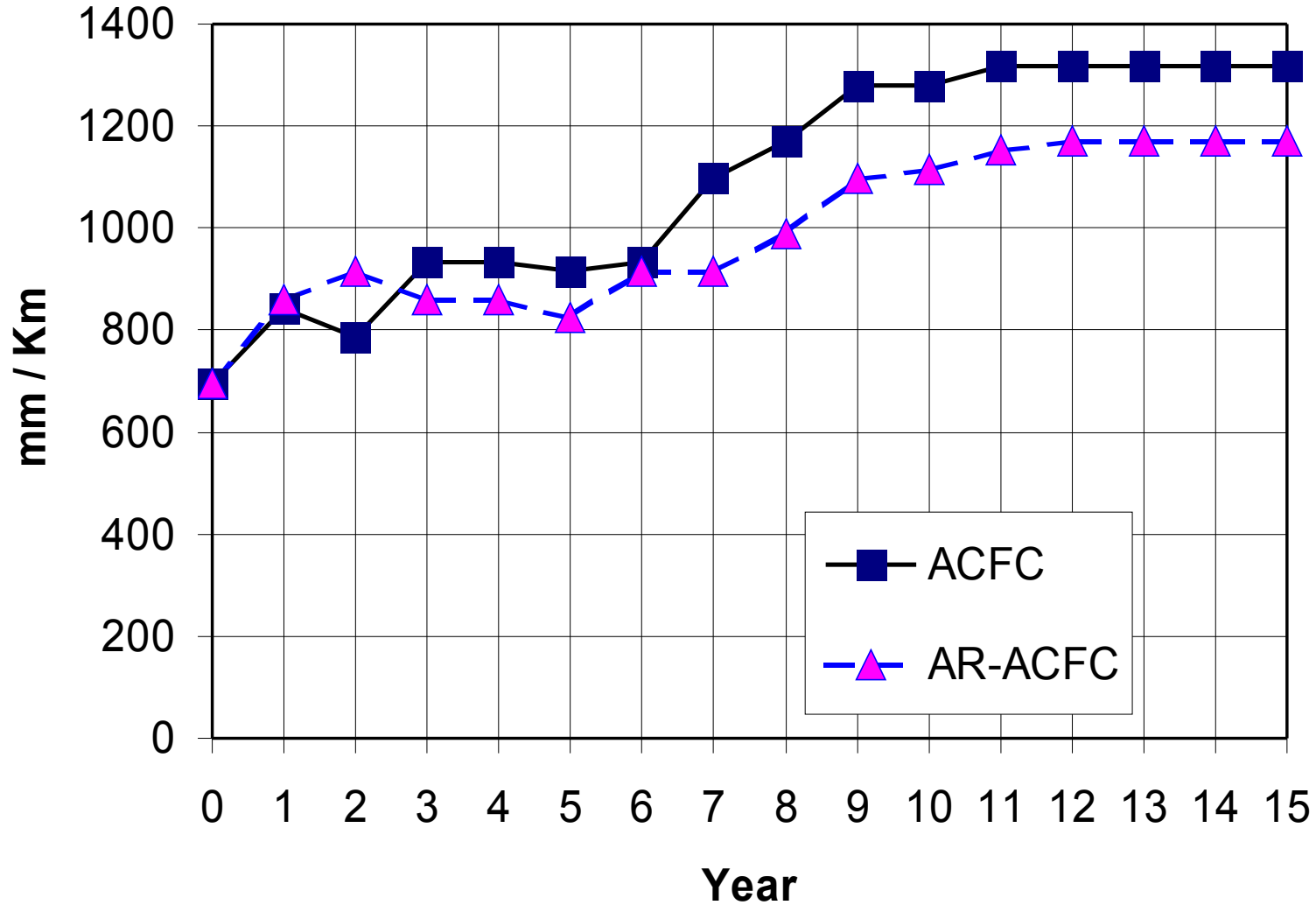
Asphalt Rubber
Open Graded

Pavimentazione
Rigida

Improves security



Smoothness mm / Km



Improves security



Accident Data: FM 1431 - Travis County - Near Jonestown
(PFC mixture was placed in February 2004)

	2001	2002	2003	2004	2005	Avg 01'-03'	Avg 04'-05'	% Change in 04' & 05'
Total # of accidents	25	48	36	17	6	36.3	11.5	-68.3
Dry weather accidents	10	22	13	15	5	15.0	10.0	-33.3
Wet weather accidents	15	26	23	2	1	21.3	1.5	-93.0
Fatalities	0	1	5	0	0	2.0	0.0	-100.0
Total injuries	25	16	21	6	2	20.7	4.0	-80.6
Incapacitating injuries*	6	4	3	0	1	4.3	0.5	-88.5
Non-incapacitating injuries	19	12	18	6	1	16.3	3.5	-78.6
Annual rainfall (inches)	42.9	36.0	21.4	52.0	22.3	33.4	37.2	11.1
Total rain days (>0.1 in.)	57	56	37	70	45	50.0	57.5	15.0

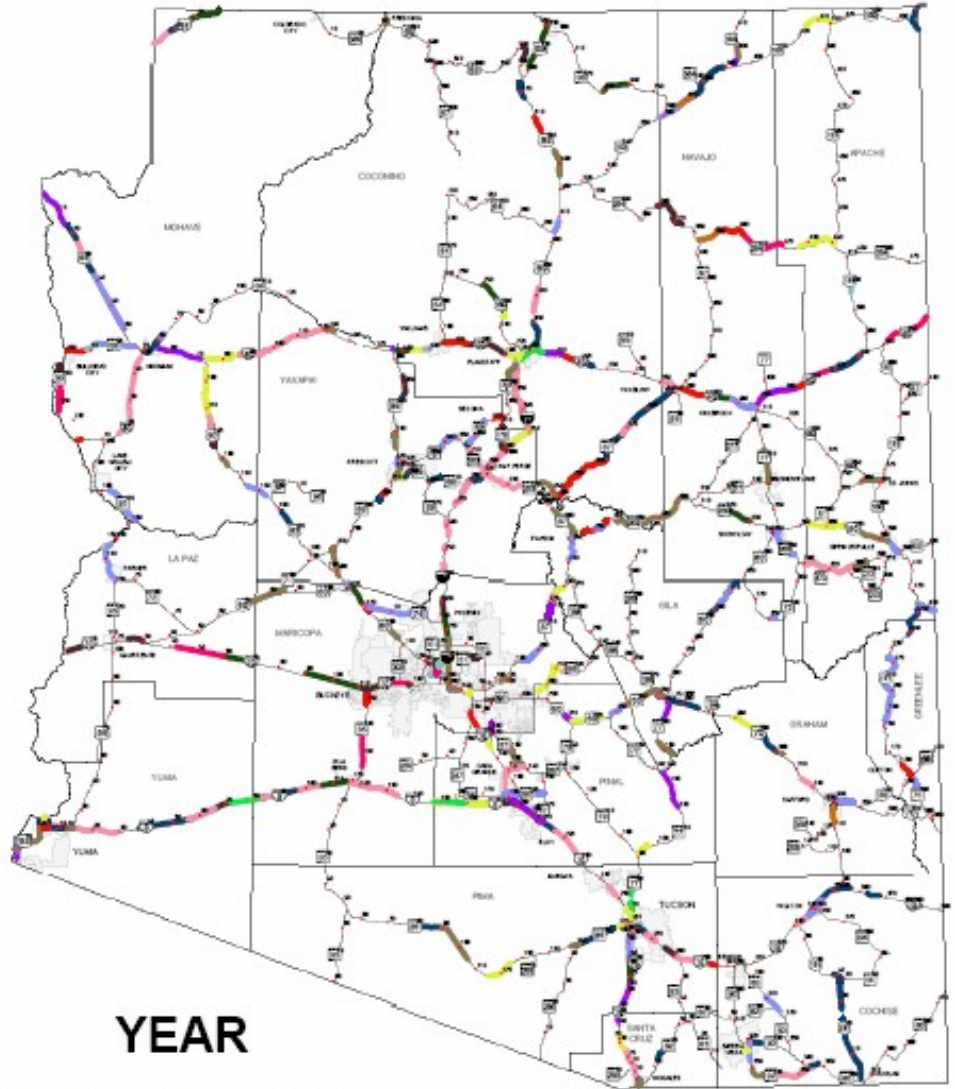
* Some of these injuries later became fatalities

Source: Cedar Park Police Department & Austin Mabry Weather Station

Environment

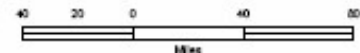


**More than 30 000000
tires were recycled
since 1988, AZ**



YEAR

- | | |
|------|------|
| 1988 | 1995 |
| 1989 | 1996 |
| 1990 | 1997 |
| 1991 | 1998 |
| 1992 | 1999 |
| 1993 | 2000 |
| 1994 | 2001 |



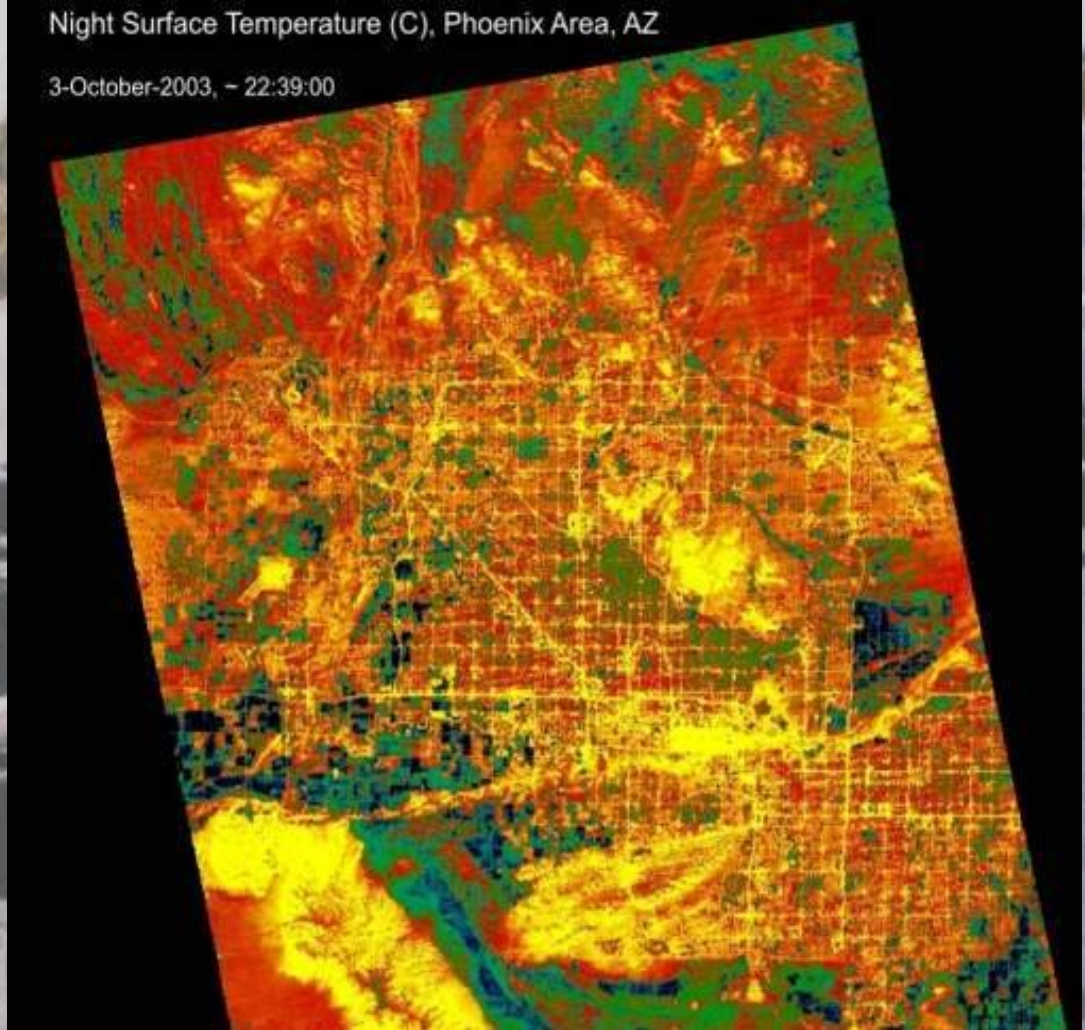
Environment

Heating

New Research



Urban Heat Island
www.urbanheat.org



Conclusions



- Asphalt-Rubber Friction Courses can enhance safety and reduce accidents
- Asphalt-Rubber Friction Courses can be applied in very thin layers on aged concrete surfaces and can be used to reduce tire noise
- Asphalt-Rubber provides a longer lasting fatigue and crack resistant surface

Thank you!

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