Rehabilitation of Portland Cement Concrete Pavements With Thin Asphalt-Rubber Open Graded Friction Course Overlays in Arizona

Douglas D. Carlson

Open Graded Friction Course

- Reduce hydroplaning
- Reduce splash and spray
- Improve friction
- Reduce noise
- Improve ride

It can't be done! Because…

- OGFCs aren't durable enough
- OGFCs delaminate and fall apart
- Asphalt-Rubber never works

Presentation Outline

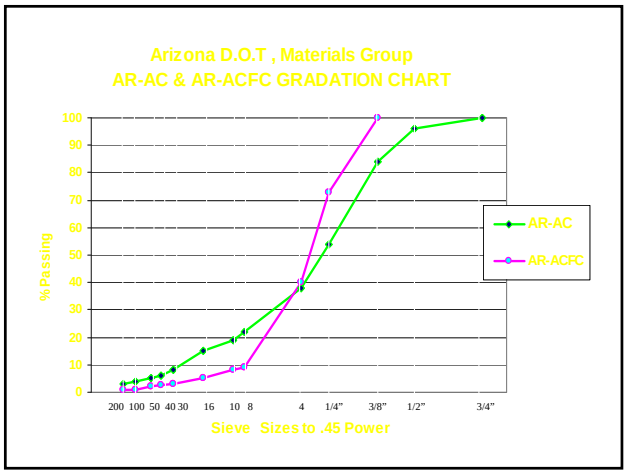
- Overview of ADOT design and application
- Performance of aged projects in diverse climates

AR-ACFC Gradation

AR Binder Content 9-10 %

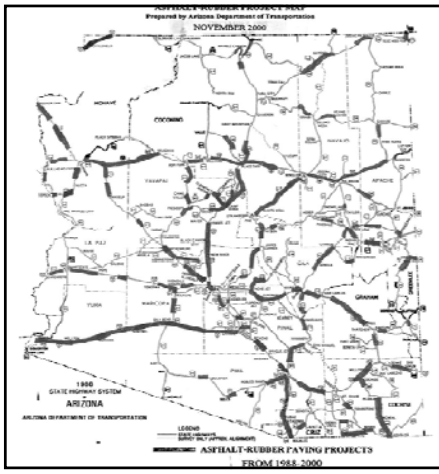
ARAC Gradation

AR Binder 7.5 – 8.5%



SHRP PG BINDER

CLIMATE ZONES



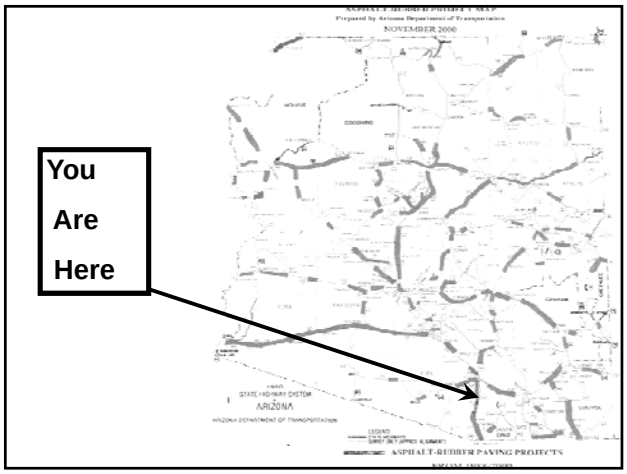
Asphalt Rubber Projects 1988-2000

AZ AR-OGFC Projects

ARACFC Projects ADOT					
Year	# Projects	Tons Mix	Tons Binder	Ton Aggregate	% Binder
2001	33	181,434	16,234	165,200	8.9%
2000	38	206,578	18,654	187,924	9.0%
1999	48	266,133	24,197	241,936	9.1%
1998	39	376,814	33,621	343,193	8.9%
1997	22	115,696	10,424	105,272	9.0%
1996	21	122,947	11,004	111,943	9.0%
1995	30	196,826	18,380	178,446	9.3%
1994	14	136,703	12,611	124,092	9.2%
1993	12	116,486	10,866	105,620	9.3%
1992	10	106,970	9,954	97,016	9.3%
1991	3	18,650	1,742	16,908	9.3%
1990	5	78,529	5,353	73,176	6.8%
1989	1	6,830	649	6,181	9.5%
1988	1	4,080	390	3,690	9.6%
14	277	1,934,676	174,079	1,760,597	9.0%

Project Information

Name	Location	PG Zone	Year Const
I-19	Tucson	PG 70-10	1988
I-17	Phoenix	PG 70-10	1990
I-17	Flagstaff	PG 58-28	1995



I-19 Project Information

- 2584 Feet Elevation
- Temperature Range 16-111 Fahrenheit
- 400,000 ESALs (per year) 39,000 ADT
- Major Truck Route from Mexico

I- 19, Tucson South MP 58-60 1988

I- 19, Tucson South MP 58-60 1988

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I- 19, Tucson South MP 58-60 2000

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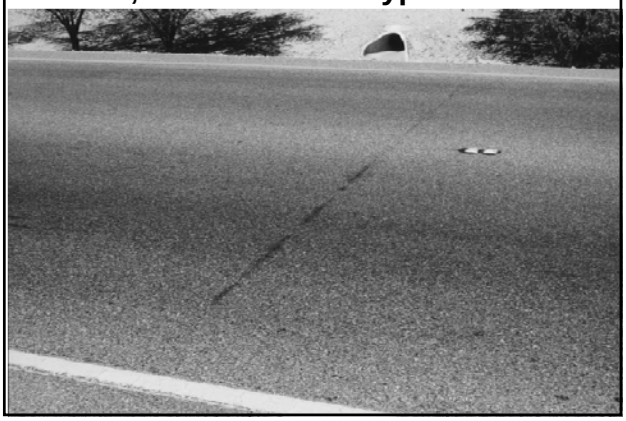
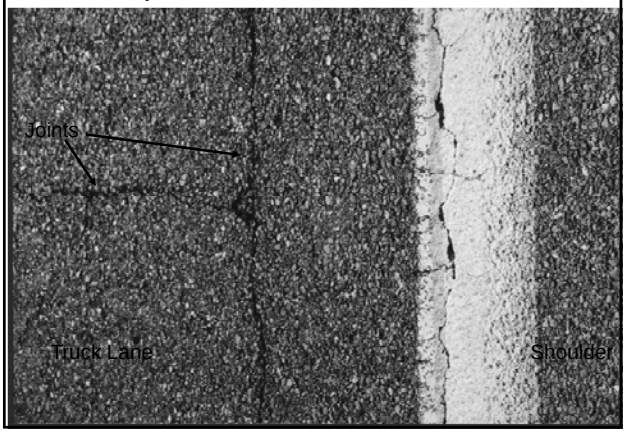
I- 19, Tucson South MP 58-60 2000

I- 19, Tucson South Typical Joint

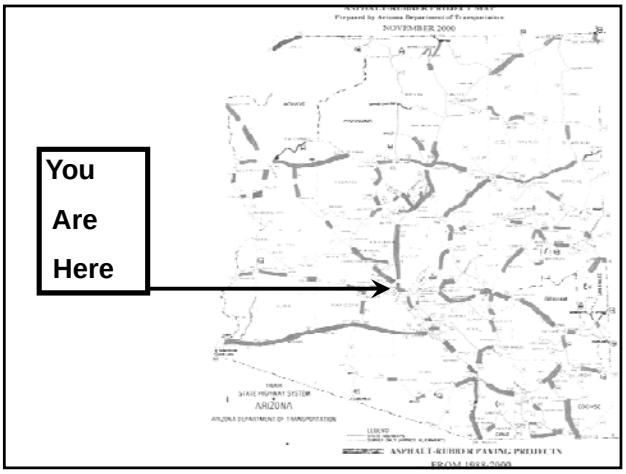


I- 19, Tucson Worst Case Crack



Interstate 19, Tucson South MP 58-60
Overlay Constructed 1988

Performance Indicators	Values Before Overlay	14 Years After Overlay
Ride inches/mile	172	70
Skid (Mu Meter)	38	64
Rutting (inches)	N/A	0.11
Percent Cracking	N/A (Trans Joint)	1%
Maintenance Cost /Lane Mi/Year	$857	$59



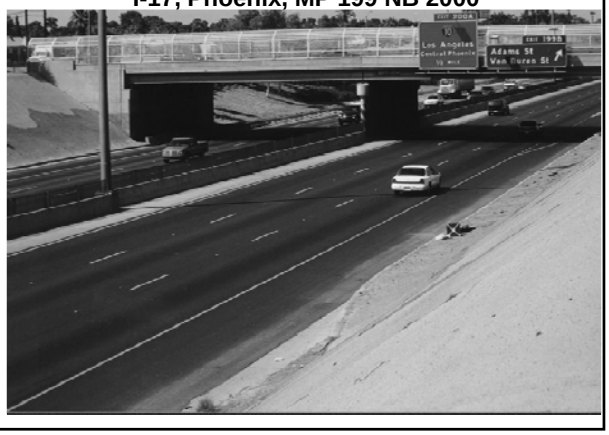
I- 17 Phoenix Project Information

- 1117 Feet Elevation
- Temperature Range 20 to 122 Fahrenheit
- Arid 6 Inches Rain
- 2,100,000 ESALs (per year) 140,000 ADT
- Very Heavy Urban Traffic Load

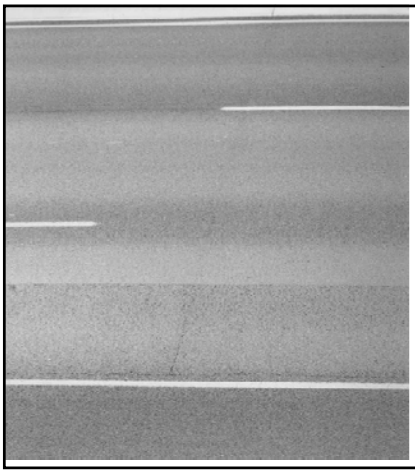
I-17, Phoenix, MP 199 NB 1990

I-17, Phoenix, 1990

I-17, Phoenix, MP 199 NB 2000



I-17, Phoenix, MP 199 NB



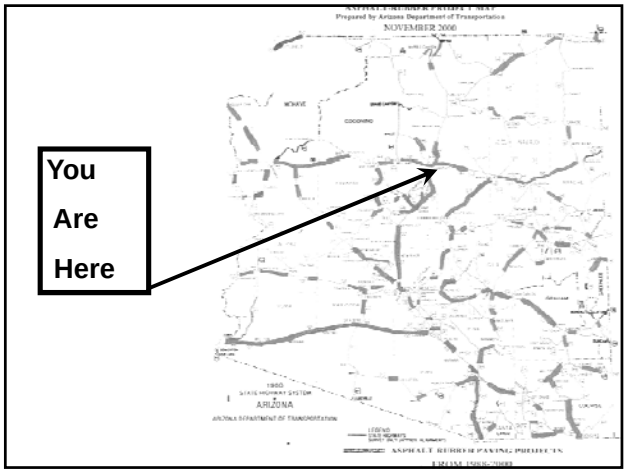
I-17, Phoenix,

MP 199 NB

Typical Section

Interstate 17, Phoenix MP 199-200 Overlay Constructed 1990

Performance Indicators	Values Before Overlay	12 Years After Overlay
Ride inches/mile	179	82
Skid (Mu Meter)	43	68
Rutting (inches)	N/A	0.28
Percent Cracking	N/A (Trans Joint)	0%
Maintenance Cost /Lane Mi/Year	$1200	$255



I-17 Flagstaff Project Information

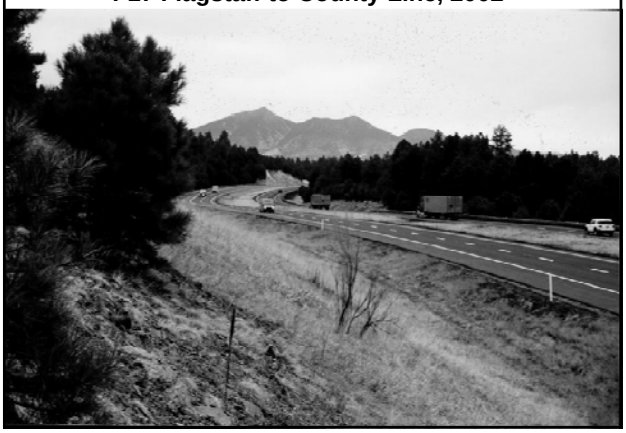
- 7000 Feet Elevation
- Temperature Range –30 to 95 Fahrenheit
- 100 Inches Snow, 30 Inches Rain
- 646,415 ESALs/Year
- 24,920 ADT

A Corrective Measure for Step-Off

I-17 Flagstaff County Line, 1992

I-17 Flagstaff 1992

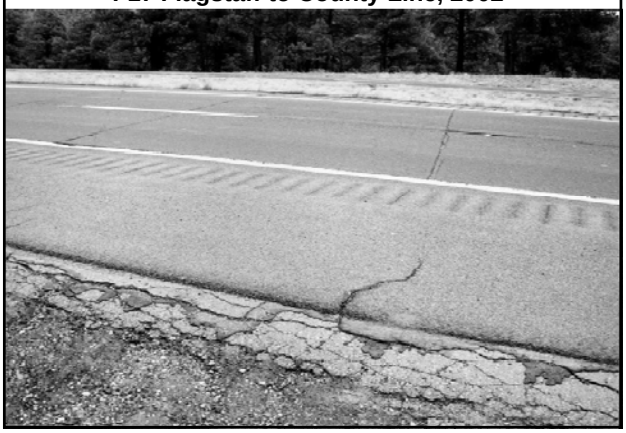
I-17 Flagstaff to County Line, 2002



I-17 Flagstaff to County Line, 2002

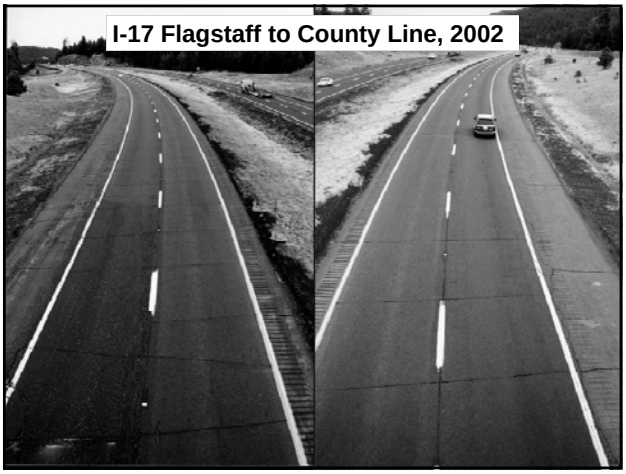
I-17 Flagstaff to County Line, 2002

I-17 Flagstaff to County Line, 2002



Joints will reflect through, but typically will not be affected by spalling.

I-17 Flagstaff to County Line, 2002



Interstate 17, Flagstaff SB 311-337
Overlay Constructed 1995

Performance Indicators	Values Before Overlay	7 Years After Overlay
Ride inches/mile	198	64
Skid (Mu Meter)	52	56
Rutting (inches)	N/A	0.05
Percent Cracking	N/A (Trans Joint)	4%
Maintenance Cost /Lane Mi/Year	$445	$214

It Works

AR OGFC Rubber Uses 1000 Tires Per Lane-Mile

AZ AR-OGFC Projects

ARACFC Projects ADOT		Tons	Pounds	Tires
Year	# Projects	Rubber	Rubber	(10 lbs)
2001	33	3,247	6,493,600	649,360
2000	38	3,731	7,461,600	746,160
1999	48	4,839	9,678,800	967,880
1998	39	6,724	13,448,400	1,344,840
1997	22	2,085	4,169,600	416,960
1996	21	2,201	4,401,600	440,160
1995	30	3,676	7,352,000	735,200
1994	14	2,522	5,044,400	504,440
1993	12	2,173	4,346,400	434,640
1992	10	1,991	3,981,600	398,160
1991	3	348	696,800	69,680
1990	5	1,071	2,141,200	214,120
1989	1	130	259,600	25,960
1988	1	78	156,000	15,600
14	277	34,816	69,631,600	6,963,160