Asphalt Rubber Finishing Course (ARFC)
The end of the road for the tire.
The beginning of the road for a quieter, smoother Pavement.

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Alaska

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ARFC

- Open graded
- Approximately 9.5% asphalt rubber
- Aggregate basically 95% 3/8” chips and 5% fines
- Get as much asphalt rubber in the mix as possible without draindown
- Used as final wearing surface, not structural
- On asphalt pavements, typically ½ inch thick
- On concrete pavements, typically 1 inch thick
Following are several slides that show the durability and performance of ARFCs.

There are many more sections of pavement where ARFCs were placed on AC pavements than where ARFCs were placed on PCCP pavements. Therefore, some of the data shown is for the larger group of AC pavement sections.

Even so, several PCCP sections with ARFC overlays are about a decade old and show excellent performance when used there.
Compared to a PCCP top surface, an ARFC on a PCC Pavement provides a smoother ride.
ARFC provides comparable Friction levels to a PCCP surface, reduces the amount of water spray, and provides increased contrast to pavement markings in wet weather.
Pavements with ARFC experience less rutting compared to those without an ARFC.
Pavements having AR as the final surface Cost less to maintain then neat AC surfaces

Maintenance Cost $/lane -Mile

- overlays / inlays neat asphalt only
- asphalt rubber projects

Graph showing maintenance cost over years for different pavement types.
ADOT PMS Data shows most pavements will experience the first crack at approximately 4 years of age. Once initial cracking occurs, AR greatly reduces the yearly increase in cracking.
ARFCs perform similarly in terms of Roughness to ACFCs during their early life but perform better during their second half of their life.
ARFCs have better Friction levels than ACFCs.
As the preceding slides have shown, AR incorporated into pavement surfacing provides measurable performance improvement in several areas and comparable performance in the remaining areas.

The oldest section of ARFC in Arizona is an overlay of PCCP on I-19 in Tucson. That section was the first of the “modern” ARFCs placed in one lift. Maintenance Costs have averaged less then $100/year.

Earlier use of ARFCs were a 3-layer system. The I-19 section was placed in 1989 and has received no major maintenance since then and is still serving traffic today. In 2006 we Hot in-place recycled a mile of it to test the viability of that approach.

It’s performance is detailed on the next slide…..
I-19, MP 59, Roughness/Cracking vs Age

Year

Crack (％)

Roughness (in/mi)

Series1

Cracking

Series2

Roughness

I-19 Project built in 1989, MP 58.5 – 60.0
I-17 SB MP 312 – 337 is located just south of Flagstaff in an area of high freeze thaw and heavy truck traffic.

The original PCCP was built in 1975 and in the years leading up to this ARFC overlay had developed extensive joint faulting, so much, in fact, that most trucks avoided the right lane and traveled in the left lane. Maintenance costs have averaged less than $100/year.
I-17 SB MP 312 – 337
2000 mu = 56

I-17 SB MP 312 - 337

Cracking (%) vs. Year
Roughness (in/mi)

Year

Roughness
Cracking
Many years of performance history of ARFCs placed in Arizona have shown it to be a durable and long lasting surfacing course.

In virtually every performance measure it does better then the comparable mix without rubber.

This is the case for both AC pavements as well as when ARFC is used as a surface course on PCC Pavements.
1. Waste tires ground to become aggregate bins.
2. Bags of crumb rubber.
3. Rubber is blended with asphalt.
4. Aggregate is heated in drums.
5. Asphalt/Rubber blend is added to aggregate.
6. Rubberized asphalt concrete is stored in silos.
7. Trucks are filled and traveled to job site for paving.
Asphalt Rubber

Specification Highlights

Approximately 20% crumb rubber by weight of asphalt cement
Sampling for Mix Design

- Representative Material
  - Witness Sampling
  - Sufficient Quantity Crushed
  - Ensure Sampling Technique

- Sample Requirements
  - Mineral Aggregate (approx. 300 lbs)
  - Crumb Rubber (5 lbs)
  - Asphalt Cement (1-gallon)
  - CRA Blend (three 1-gallon)
  - Mineral Admixture (1-gallon)
Paving Temperature
AR-ACFC

- Surface at least 85° F
- Do we deviate from this???
  - Yes
- We have paved in the 40’s
AR-ACFC Paving Season

- Varies depending on elevation
- See Special Provisions
- Generally we try and pave between 85 and 100 surface temperatures.
- At higher temperatures we try for a minimum 24 hour traffic free cure period and spray with lime-water
Tack Coat

- Clean and dry surface
- Certified Boot Truck
- Specifications require the use of Tack
- We have used both emulsion and paving grade tack coats
Acceptance Testing - Binder

- Asphalt cement
  - PG grade verification

- Crumb Rubber Asphalt
  - resilience
  - penetration
  - viscosity
  - softening point
Resilience Test
Penetration
Viscosity
Softening point
Acceptance Testing - Aggregate

- Aggregate Properties
  - Gradation
  - sand equivalent
  - fractured faces
  - flakiness
Acceptance Testing - Mix

- Binder Content
- Moisture Content
- Testing by Contractor Q/C, witnessed by ADOT
- Calibration Pans prepared by Contractor (typical)
Compaction Requirements
AR-ACFC

- Temperature just prior to compaction at least 275° F.
- Minimum of three static steel wheel compactors.
- Two initial compactors to cover the entire width of the ribbon with one pass.
- No vibration.
Compaction Requirements
AR-ACFC

- Breakdown rollers stay within 300 ft of laydown machine
- Final rollers stay as close as possible to initial breakdown
- Rollers make as many passes as is possible before the temperature of the asphaltic concrete falls below 220 °F
Special Binder Issues

- **Reaction time:**

  After proportioning and thoroughly mixing the asphalt cement and ground rubber, the mixture must be allowed to react for a minimum of one hour.
Special Binder Issues

- During production, must be held between 325°F and 375°F
- May not be held above 325°F for more than 10 hours
- May be cooled and gradually reheated ONE time
- May not hold above 250°F for more than four days
Questions ??