Arizona DOT's Use of Modifier Binders

Julie Kliewer

State Construction and Materials Engineer

ADOT Terminology

- Asphalt-Rubber Material aka crumb rubber asphalt (CRA)
  - Wet process, minimum 20% crumb rubber
  - Rotational viscosity, Pen (39.2° F), softening point, resilience (77° F)

ADOT Terminology

- Terminal Blend: TR+ (hybrid binder)
  - Minimum 8% crumb rubber
  - Minimum 2% SBS polymer

ADOT Standard Practices

- In most situations, binder is paid for separately from mix
- Mandatory use of mineral admixtures, typically 1% Lime or Cement (no liquid anti-strip)

ADOT Standard Practice

- The majority of our highways have an asphalt rubber friction coarse as the final wearing surface
  - Open graded, typical 9.5% binder content

Early Policy on Modification

- Tell the supplier the grade desired
- Let the supplier decide how to get there
- Avoid implementing plus specifications

What did we get:

- Neat asphalts
- Air blown asphalts
- Acid modified asphalts
- Occasionally polymer modified asphalts

History

- High usage of crumb rubber asphalt (CRA)
- Low usage of polymer modified binders

Crumb Rubber Asphalt (CRA)

- 20% crumb rubber by weight of asphalt cement
- Added to 350 – 400° F asphalt cement
- Reacted for at least one hour at 325 – 375° F with agitation

Crumb Rubber Asphalt

Property	CRA-1	CRA-2	CRA-3
Base asphalt	PG64-16	PG58-22	PG52-28
Rotational Viscosity, 350°F, Pa-seconds	1.5-4.0	1.5-4.0	1.5-4.0
Pen, 39.2°F, 200g, 60 sec, min	10	15	25
Softening Pt, °C, min	57	54	52
Resilience, 77°F, %, min	30	25	20

Polymer modified asphalts

- Supplier driven
- Generally didn’t specify unless doing test sections (e.g. Boulders aging study)

History

- CRA used in both structural layers and friction courses for many years
- Major unresolved failures in ARAC caused it to fall out of favor

Addition of Terminal Blends to tool box

- Used as an alternative to CRA
- Used when the use of CRA not economical (small quantities)
- Used in dense graded mixes as replacement for ARAC

Terminal Blend (TR+)

- Broke our rule about plus specifications
- Requires minimum 2% SBS
- Requires minimum 8% ground tire rubber
- Phase angle requirement
- Elastic recovery requirement

AZ BINDER USAGE

YEAR	BINDER TONS	CRA	TR+	UNSPECIFIED
2000	135,661	54,093 (39.9%) {$160}	0 (0%)	81,568 (60.1%) {$275}
2004	117,749	55,819 (47.4%) {$245}	0 (0%)	61,930 (52.6%) {$205}
2015	64,829	7653 (11.8%) {$540}	7419 (11.4%) {$900}	48,757 (76.8%) {$500}
2016	76,367	11,932 (15.6%) {$525}	2992 (3.9%) {$750}	61,443 (80.6%) {$520}
2017	76,569	17,638 (23.0%) {$390}	2624 (3.3%) {$750}	56,307 (73.5%) {$410}

Other usage notes

- ADOT favors the use of modified binders for chip seals

Where are we heading

- Evaluating the use of MSCR
- Looking to increase use of polymer modified binders especially in the colder regions of state

What to expect in the future

- Crumb Rubber Asphalt (CRA) [ground tire rubber modified] produced via the wet process is not going away

What to expect in the future

- An increase in the use of polymer modified asphalts in areas where the greatest value can be obtained

What not to expect

- A high percentage of binders being required to be polymer modified

Final Words of Wisdom

- Modified binders are part of the tools we have in our tool box
- The perfect binder loses its value if the mix design is poor or it is not constructed well