SUSTAINABLE PAVEMENT TECHNOLOGY

Rubberized Asphalt Paving, Patching & Stress-Absorbing Membranes Interlay

Materials, Construction & Field Performance | Serji Amirkhanian | 2026

Overview

1. **Crumb Rubber**
   Turning scrap tires into engineered pavement material

2. **Rubberized Asphalt**
   Longer-lasting, crack- and rut-resistant pavement

3. **Patching Solutions**
   Durable concrete and open-graded (OGFC) repairs

4. **Stress-Absorbing Membranes**
   SAM surface treatments and SAMI interlayers

5. **Field Performance**
   Decades of proven results across the U.S. and abroad

SECTION 01

Crumb Rubber

From scrap tires to high-performance engineered pavement material

Recycled tire crumb rubber

Why Municipalities Win

Preservation and permanent repair — the constituent and cost case

Asphalt Pavement Preservation and Permanent Pothole Repair Solutions empower municipalities to provide constituent satisfaction (no damage or complaints from roads in disrepair) and also substantial maintenance cost mitigation.

Happy residents, happier politicians looking to "cut ribbons" and turn campaign issues into solutions…Win/Win.

Crumb Rubber: Many Uses, One Priority

Recycled tire rubber feeds a wide range of products — pavement is the highest-volume use.

Rubberized Asphalt

Highest-volume, highest-value use — quieter, longer-lasting roads

Rubber-Modified Concrete

Improved toughness and crack resistance in rigid pavements

Sports Fields & Tracks

Resilient synthetic-turf infill and running-track surfaces

Playground Surfacing

Soft, impact-absorbing safety surfaces for parks and schools

Molded & Extruded Goods

Pallets, railroad ties, mats, tiles, and other molded industrial products

Landscape Mulch

Durable, non-fading ground cover that resists decay

The U.S. Scrap-Tire Challenge

330

MILLION

scrap tires generated in the U.S. every year — about one tire per person

A recycling success story

Engineered markets now recover the large majority of scrap tires each year.

Legacy stockpiles were hazardous

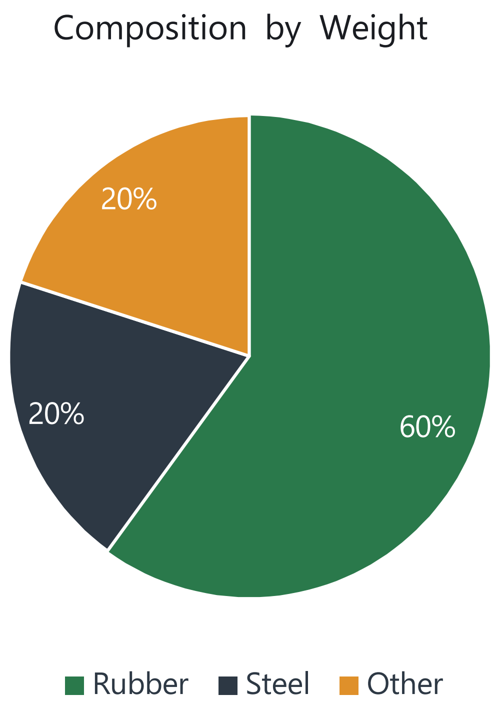
Abandoned tire piles fueled fires and bred mosquitoes for decades.

Pavement leads the way

Rubberized asphalt is one of the highest-volume beneficial uses of crumb rubber.

Anatomy of a Passenger Tire

By weight, roughly 60% rubber — the fraction recovered as crumb for pavement.



Typical Composition

- Synthetic & natural rubber
- Carbon black & silica (reinforcing fillers)
- Steel wire (belts & bead)
- Textile fabric (polyester, nylon)
- Oils, waxes & resins
- Sulfur & zinc oxide (vulcanizing)

From Scrap Tire to Crumb Rubber

Whole tires are shredded, cleaned of steel and fiber, then ground to precise crumb sizes.

01
Whole Tires
Collected scrap tires are fed into a primary shredder

02
Shredding
Secondary shredder reduces size; steel and fiber removed

03
Grinding
Ambient, cryogenic, or wet-grind to the target crumb size

04
Crumb Rubber
Sized, clean rubber is bagged in one-ton super sacks

GRINDING METHODS

Ambient
Ground at room temperature — rough, high-surface-area particles

Cryogenic
Frozen with liquid nitrogen — clean, smooth fracture surfaces

Wet Grind
Water-based milling — very fine crumb for premium binders

SECTION 02

Rubberized Asphalt

Longer pavement life, fewer cracks, and lower lifetime cost

Rubberized asphalt pavement in service

What Is Asphalt Rubber?

A hot blend of paving-grade asphalt and recycled crumb rubber — a minimum of 15% by weight of binder.

Neat Asphalt	+	Crumb Rubber	→	Asphalt-Rubber
Paving-grade binder		≥ 15% of binder weight		Elastic, high-viscosity binder

Wet process

Rubber reacts with hot binder, swelling and chemically modifying it

High viscosity

Thick, elastic binder resists cracking, rutting, and aging

Versatile

Used in gap-, open-, and dense-graded mixes plus seal coats

Standard equipment

Placed with conventional HMA paving and compaction gear

Advantages of Rubberized Asphalt

1

Longer Pavement Life

Extends service life and defers costly reconstruction

2

Crack Resistance

Elastic binder bridges and resists reflective cracking

3

Rut Resistance

Stiffer at high temperatures to resist deformation

4

Slower Aging

Rubber antioxidants reduce oxidation and hardening

5

Lower Maintenance

Fewer repairs mean lower life-cycle cost

6

Quieter Roads

Absorbs tire noise for reduced traffic sound

7

Better Skid Resistance

Improved surface texture and wet-weather safety

8

Standard Equipment

Uses conventional HMA plants, pavers, and rollers

Considerations — and Why They're Manageable

CONSIDERATION	WHY IT'S MANAGEABLE
Higher initial cost	Lower life-cycle cost — fewer overlays and repairs offset the premium
Fewer experienced contractors early	Training and supplier support have matured over 40+ years
Needs blending unit / pre-blended binder	Suppliers now deliver terminal-blended binder, ready to use
Requires agitated storage tank	Standard equipment at plants running modified binders
Slightly higher production temperatures	Managed with warm-mix additives and modern plant controls

Performance & Longevity

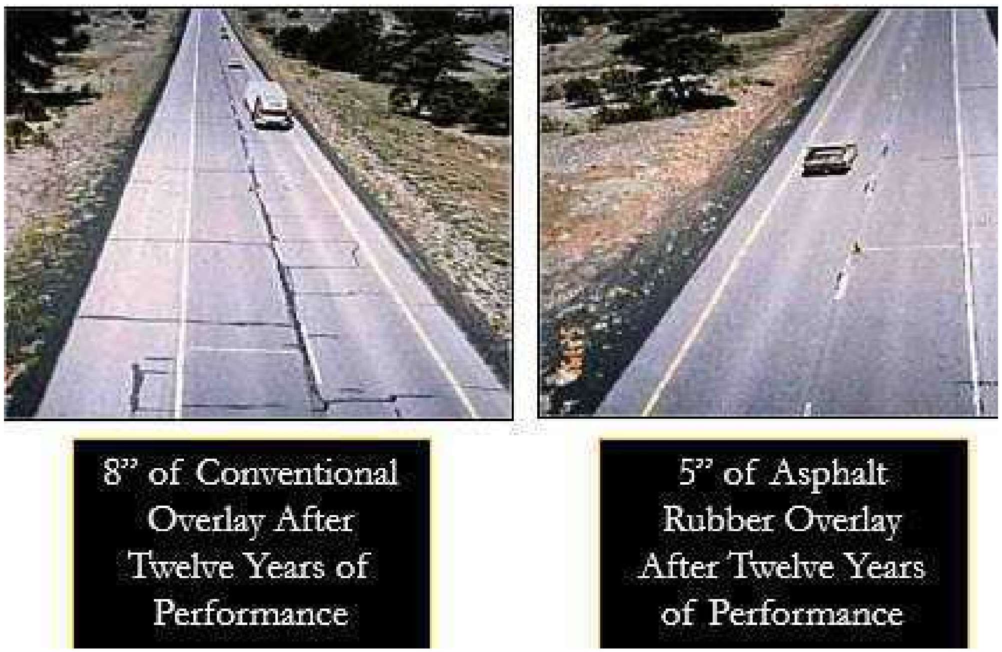
14 years after an asphalt-rubber overlay on I-19 (Tucson, AZ), maintenance cost fell 93%.

Performance Indicator	Before Overlay	14 Years After
Ride quality (in/mile)	172	70
Skid resistance (Mu Meter)	38	64
Rutting (inches)	N/A	0.11
Cracking	N/A	1% (trans. joint)
Maintenance cost ($/lane-mi/yr)	$857	$59

Source: ADOT I-19 Asphalt Rubber Project, Tucson, AZ (MP 58–60).

Proven in the Field: I-40, Arizona

Twelve years after paving — the same highway, side by side.



Same road, twelve years on

- A 5-inch asphalt-rubber overlay outlasted an 8-inch conventional one.
- Less cracking and raveling — despite being thinner.
- Less material, longer intervals between resurfacings.

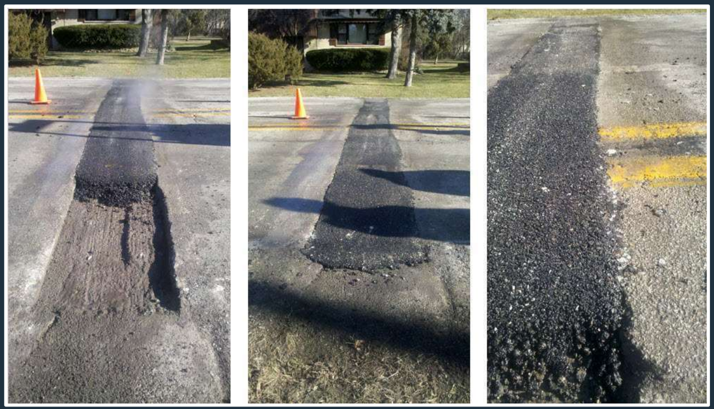
The takeaway

Rubberized asphalt delivers more performance from less material.

SECTION 03

Patching Solutions

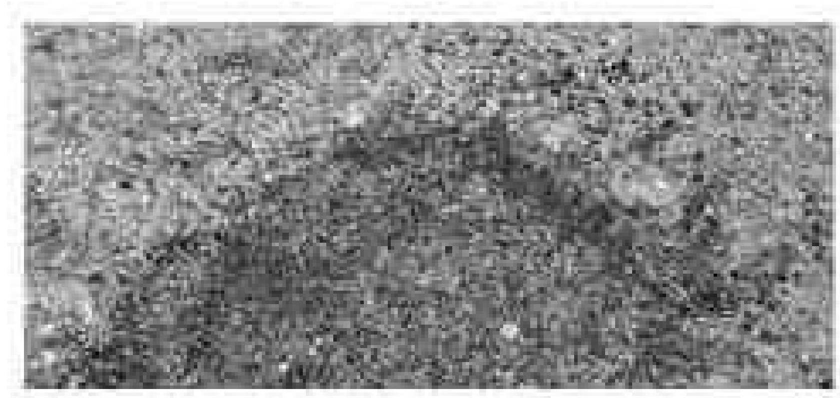
Durable repairs for concrete joints and open-graded surfaces



Rubberized patch placement

Patching: Fast, Durable Repairs

I-85, Atlanta — 300,000 vehicles a day, 30% trucks. Rubberized hot-mix and OGFC patches.



Compaction is everything

Proper compaction is the single biggest driver of patch life.

Minimal lane closure

Patches are placed and reopened fast on heavy-traffic lanes.

Patches that last

Rubberized and OGFC repairs outlast repeated conventional fixes.

The Real Cost Equation

"Pay now — or pay more later."

Evaluate life-cycle cost, not the initial sticker price.

One fix vs. three or four

Rubberized sections need far fewer repair cycles each year.

Hidden costs add up

Lane closures, labor, and traffic delays all cost the public.

Life-cycle, not sticker price

A higher upfront cost routinely wins over the full service life.

Green and fiscally sound

Recycles scrap tires while protecting taxpayer dollars.

Case Study: Interstate Toll Road, China

Three test sections designed at Wuhan University of Technology, monitored for over a decade.

SBS

Polymer control

20 tons · 40 m

Rubberized Mix 1

PelletPlus rubber

20 tons · 40 m

Rubberized Mix 2

PelletPlus rubber

60 tons · 120 m

2014 – 2025: surface cracks have not penetrated the rubberized (PelletPlus) sections.

Over ten years of field monitoring — excellent, durable performance.

4-lane interstate toll road

Existing pavement milled

4 cm overlay placed

Mix design: S. Amirkhanian, WUT

SECTION 04

Stress-Absorbing Membranes

SAM and SAMI systems that keep cracks from coming back

Spraying the asphalt-rubber membrane

Two Systems, One Technology: SAM vs. SAMI

Both are asphalt-rubber seal coats — the same binder + aggregate chips, used in different positions.

	SAM	SAMI
POSITION	On top — it is the riding surface	Buried beneath a new HMA overlay
PRIMARY ROLE	Seals and waterproofs aged pavement	Absorbs stress; stops reflective cracking
TRAFFIC RUNS ON	The SAM surface itself	The new HMA surface above it
BEST FOR	Preservation of oxidized / lightly cracked roads	Rehabilitation of cracked / jointed pavement

SAM: Stress-Absorbing Membrane

A sprayed asphalt-rubber layer chipped with aggregate — the riding surface itself.

↑ Traffic runs directly on the SAM surface

How it works

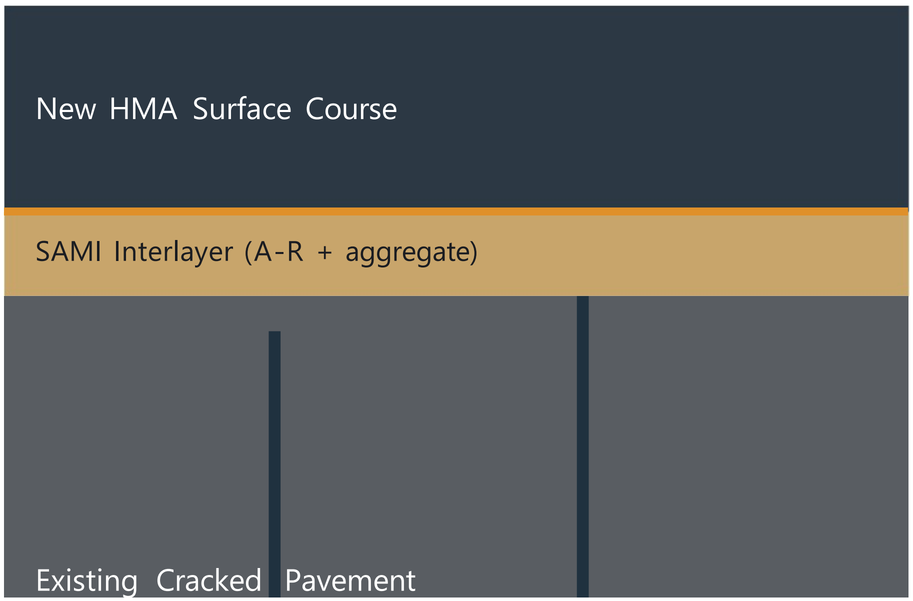
Hot asphalt-rubber binder is sprayed onto the existing road, immediately covered with aggregate chips, rolled, and sealed — forming a flexible, waterproof wearing surface.

BEST USED FOR

- Sealing aged, oxidized or lightly cracked pavement
- Restoring skid resistance and waterproofing
- Low-cost preservation without a full overlay

SAMI: Stress-Absorbing Membrane Interlayer

The same asphalt-rubber layer — but buried under a new HMA overlay to stop reflective cracking.



↑ Cracks stop at the interlayer — they don't reflect through

How it works

Placed between the old pavement and a new overlay, the elastic membrane absorbs movement at existing cracks and joints, delaying 'reflective' cracks in the new surface.

BEST USED FOR

- Overlays on badly cracked or jointed pavements
- Extending the life of new HMA surfaces
- High-traffic roads and reflective-crack-prone joints

SAMI Construction: Four Steps

1. **Spray asphalt-rubber binder**
   A hot, thick membrane is applied to the prepared pavement.

2. **Apply aggregate**
   Cover chips are spread evenly into the binder.

3. **Seat with rollers**
   Rubber-tire rollers embed the aggregate firmly.

4. **Place HMA surface**
   A hot-mix overlay is paved over the interlayer.

SECTION 05

Field Performance

Decades of documented results across the U.S. and abroad

US Hwy 76, Newberry County, SC

Field Projects Across the U.S.

Asphalt-rubber SAM and SAMI systems, documented across decades of service.

US Hwy 76
Newberry County, SC · SAMI interlayer

US Hwy 52 (Rivers Ave.)
Charleston County, SC · SAMI interlayer

US 62 / 82
Lubbock, TX · SAM · 15+ years

Flagstaff, AZ (2001)
Interstate SAMI · 12+ years

Durango Street (2019)
Two-layer preservation system

Asphalt-rubber SAMI — 16 years of proven service

Proven Over 15 Years — Lubbock, Texas

The same pavement section, photographed 15 years apart after a stress-absorbing membrane treatment.

1985 · BEFORE TREATMENT

2000 · AFTER 15 YEARS

Durango Street: Two-Layer Preservation

A double SAMI + hot-mix system placed in 2019 — the same street, three years apart.

2019 · Before treatment

2022 · After 3 years

Key Takeaways

1 **Environmental win**

Diverts millions of scrap tires from landfills and stockpiles

2 **Compelling economics**

Higher upfront cost, lower life-cycle cost over time

3 **Material compatibility**

Runs on standard HMA plants, pavers, and rollers

4 **Fully recyclable**

Rubberized pavement can be milled and reused as RAP

5 **Public perception**

Quieter, safer, longer-lasting roads build public support

6 **Growing acceptance**

Adopted by DOTs and agencies across the U.S. and abroad

About Dr. Serji N. Amirkhanian

Academic leadership

Former Mays Professor of Transportation and Director of the Asphalt Rubber Technology Service (ARTS) at Clemson University, which he founded in 2000.

Global appointments

Faculty and research roles at the University of Alabama, Tongji University (Shanghai), UNLV, Arizona State, IIT Madras and NTNU (Norway); Co-Director of the International Recycled Rubber Products Initiative at UNLV.

Industry & recognition

President & CEO of GEIG, Asphalt Technologies and Gulfstream Chemicals. Elected to the European Union Academy of Sciences (2018) and to the technical advisory boards of the European Waste Tire Association and the Rubber Pavements Association.

40+

Years in asphalt and polymer research

$27M

Research and training funding

300+

Refereed papers, conference papers and reports

14,238

Google Scholar citations (h-index 69)

450+

Invited presentations worldwide

4,000+

Professionals certified via SCDOT / FHWA program

Next Steps — Project Scope

1. **New pavement**
   Scope, location and expected traffic loads

2. **Resurfacing**
   Overlay or mill-and-fill; current surface condition

3. **Pothole patching**
   Repair volume, sites and maintenance cycle

4. **Paving equipment**
   Pavers, rollers, milling — owned, rented or needed

5. **Asphalt plant access**
   Haul distance and rubberized mix capability

6. **Timeline & budget**
   Target start date, phasing and budget range

RUBBERIZED ASPHALT PAVING · PATCHING · SAMI

Thank You

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Questions and project inquiries welcome.