

Waste Tire Recycling, Yesterday, Today and Tomorrow

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Presentation Outline

- ❖ Scrap Tire Overview
- ❖ Production Methods
- ❖ Technical Aspects and Effect of Rubber Particle in Asphalt Pavements

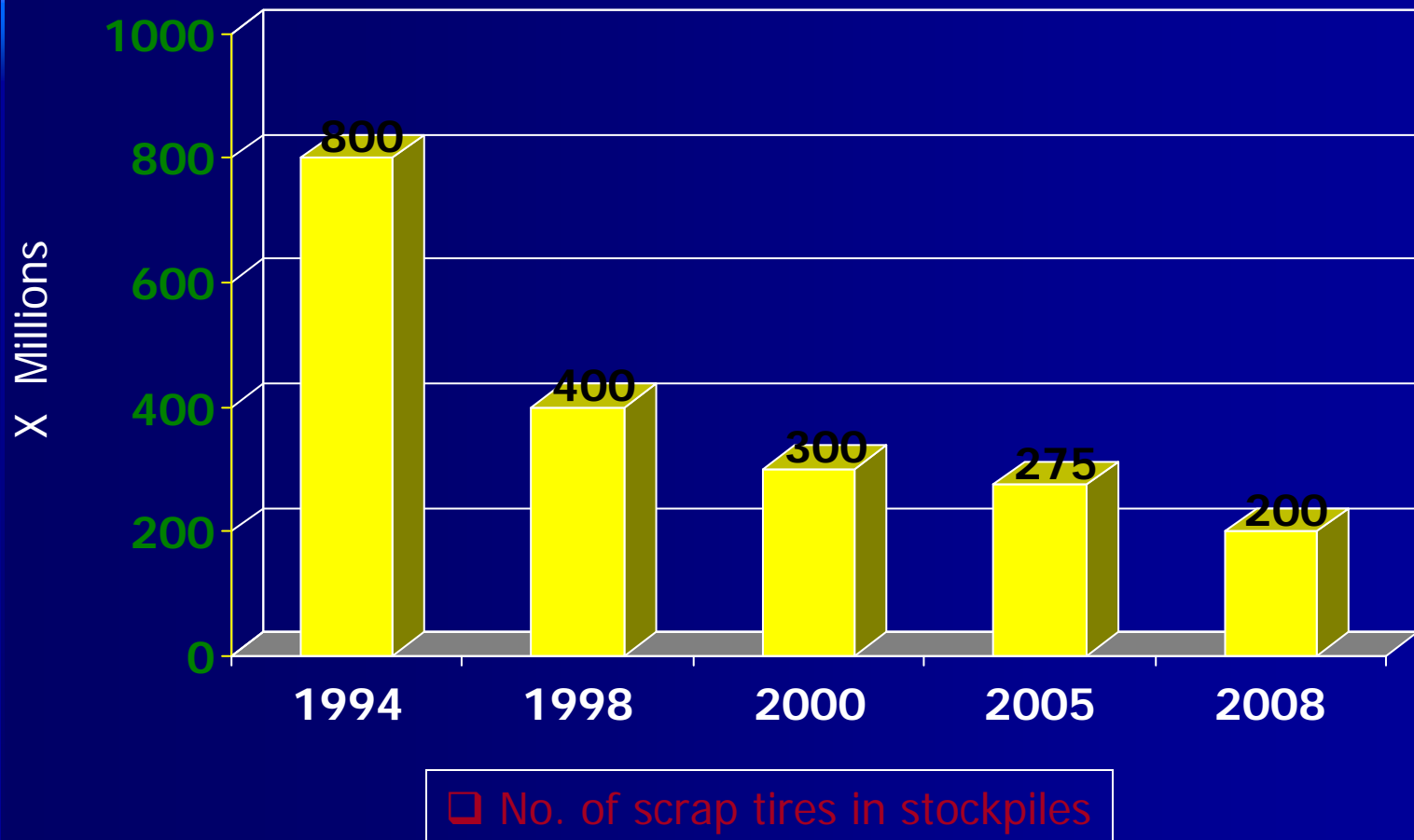
Annual Scrap Tire Generation

❖ U.S. = 300 Million

❖ Europe = 350 Million

❖ Canada = 33 Million

Stockpile Abatement – U.S.



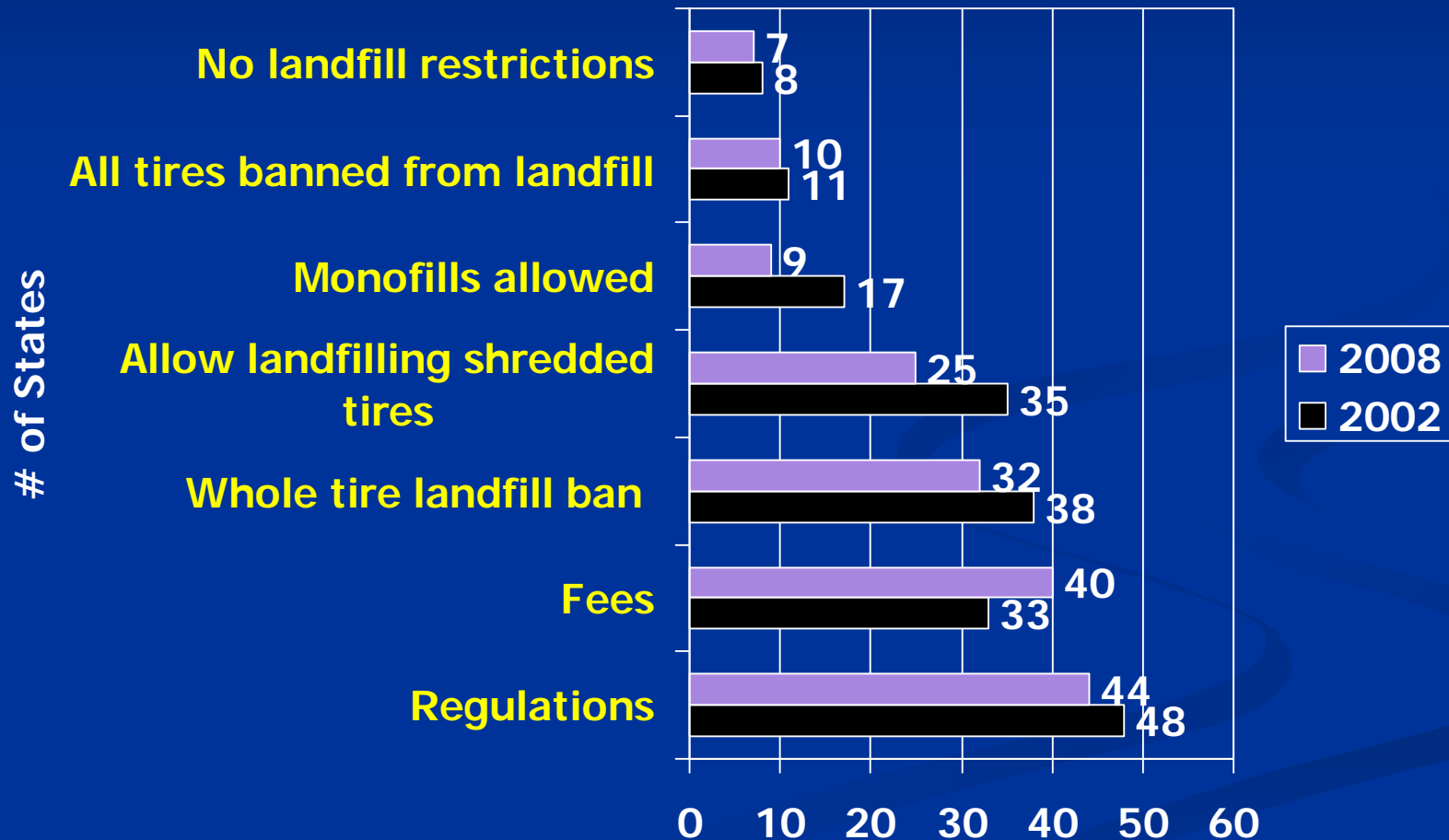
Stockpile Abatement – Europe



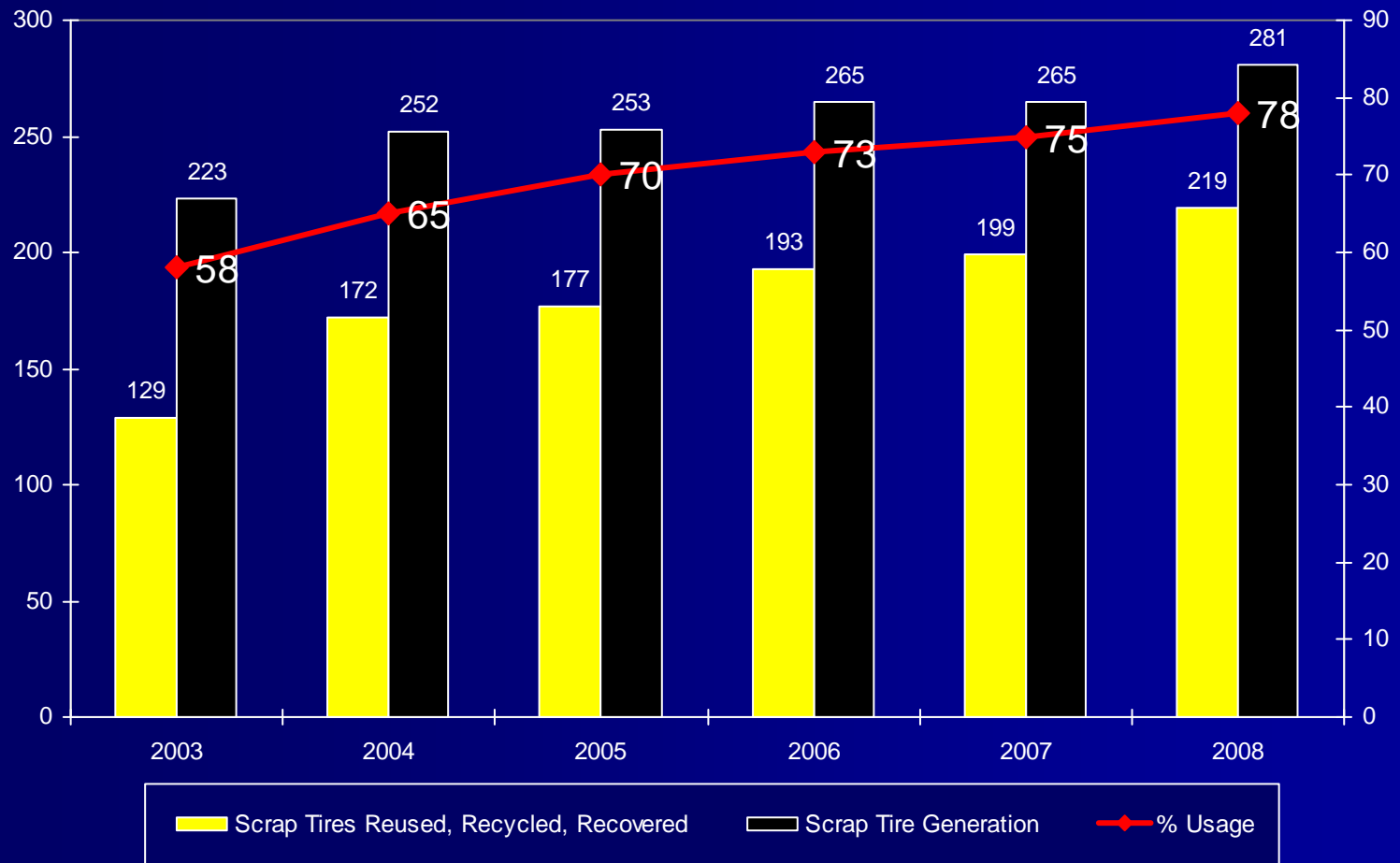
Canadian Waste Tires Exported To U.S.



State Scrap Tire Management Programs-2008 vs. 2002

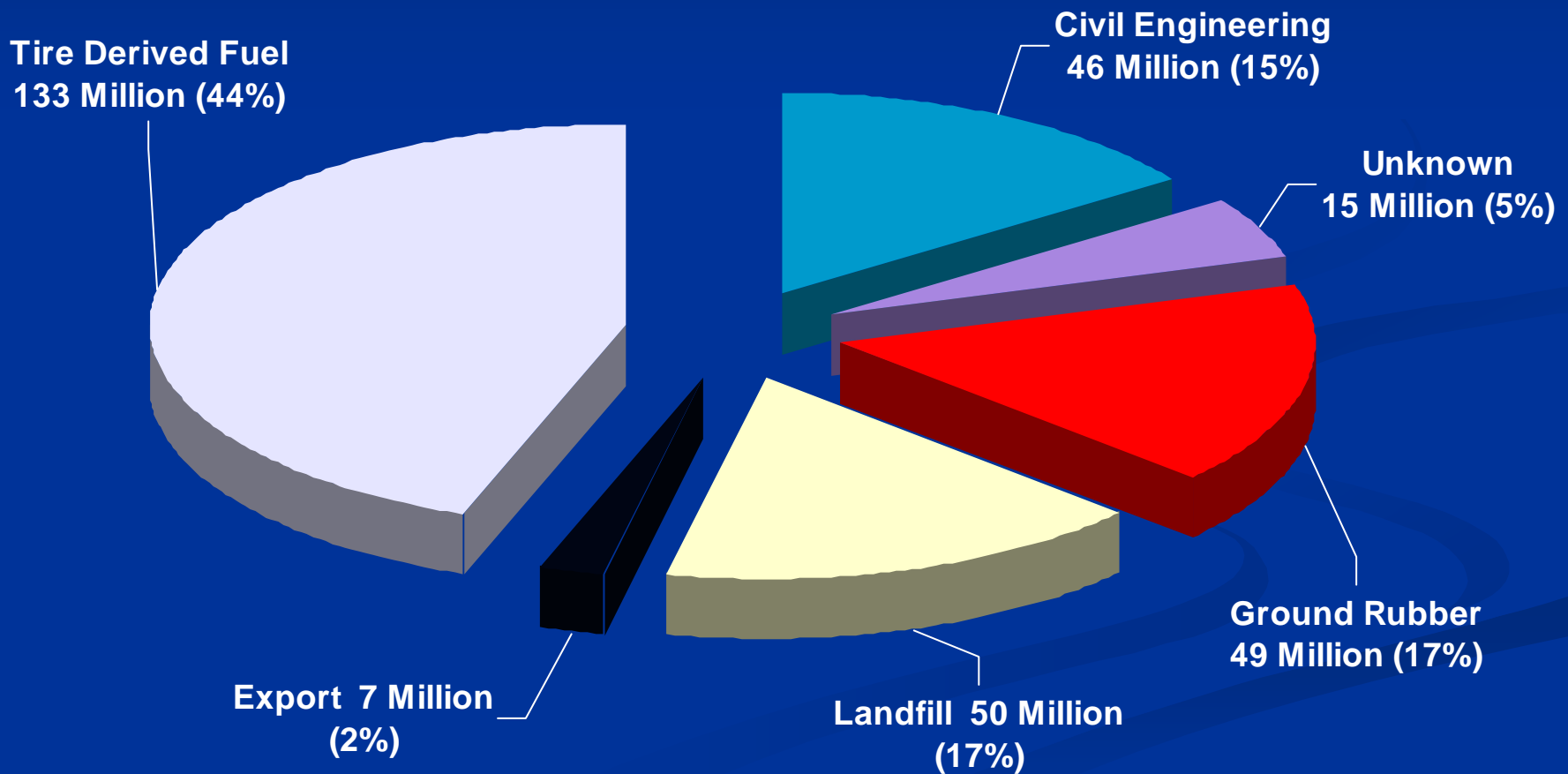


U.S. Scrap Tire Markets

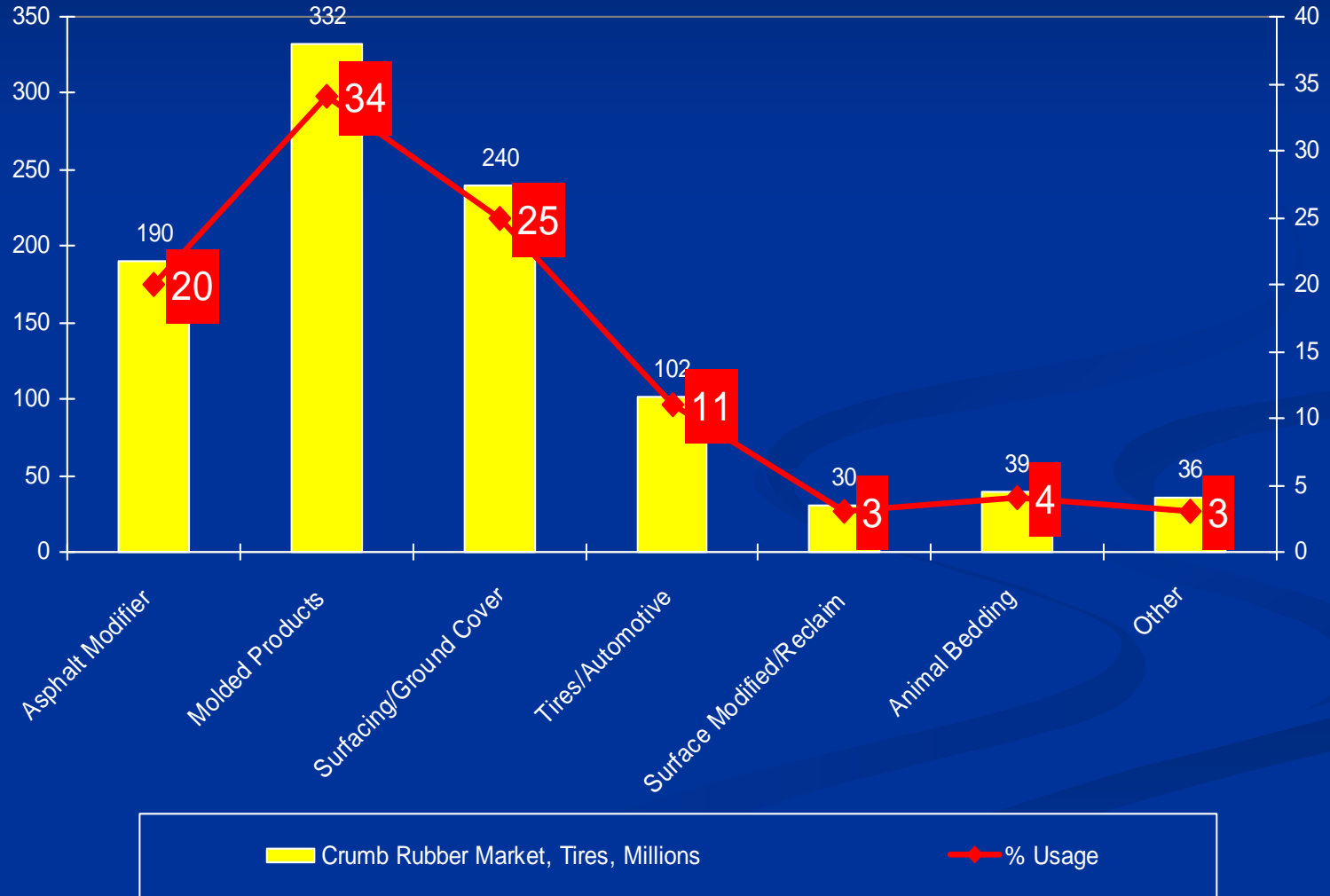


2008 US Scrap Tire Markets

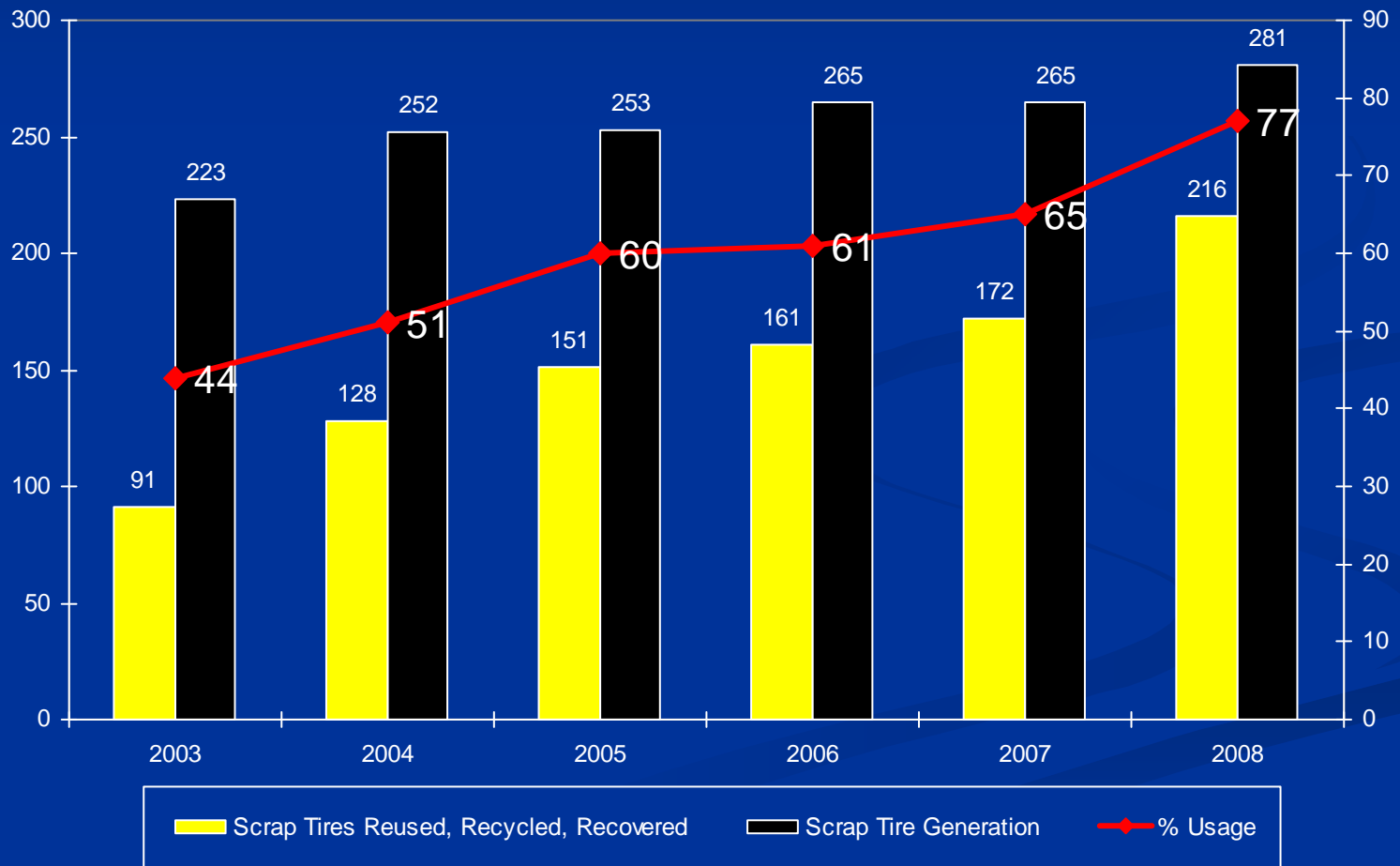
Annual Generation: 300 Million Tires



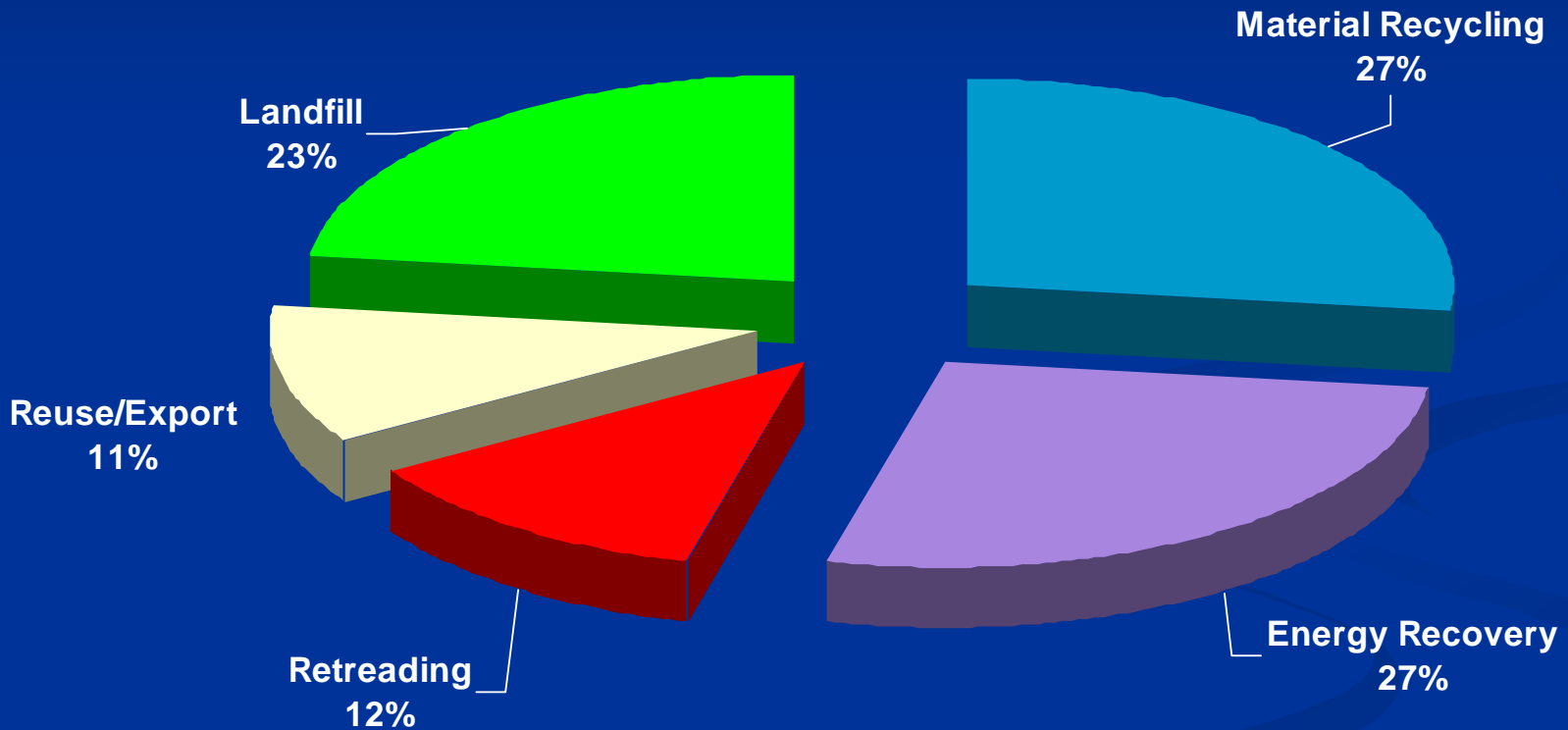
2008 Crumb Rubber Markets



European Scrap Tire Markets



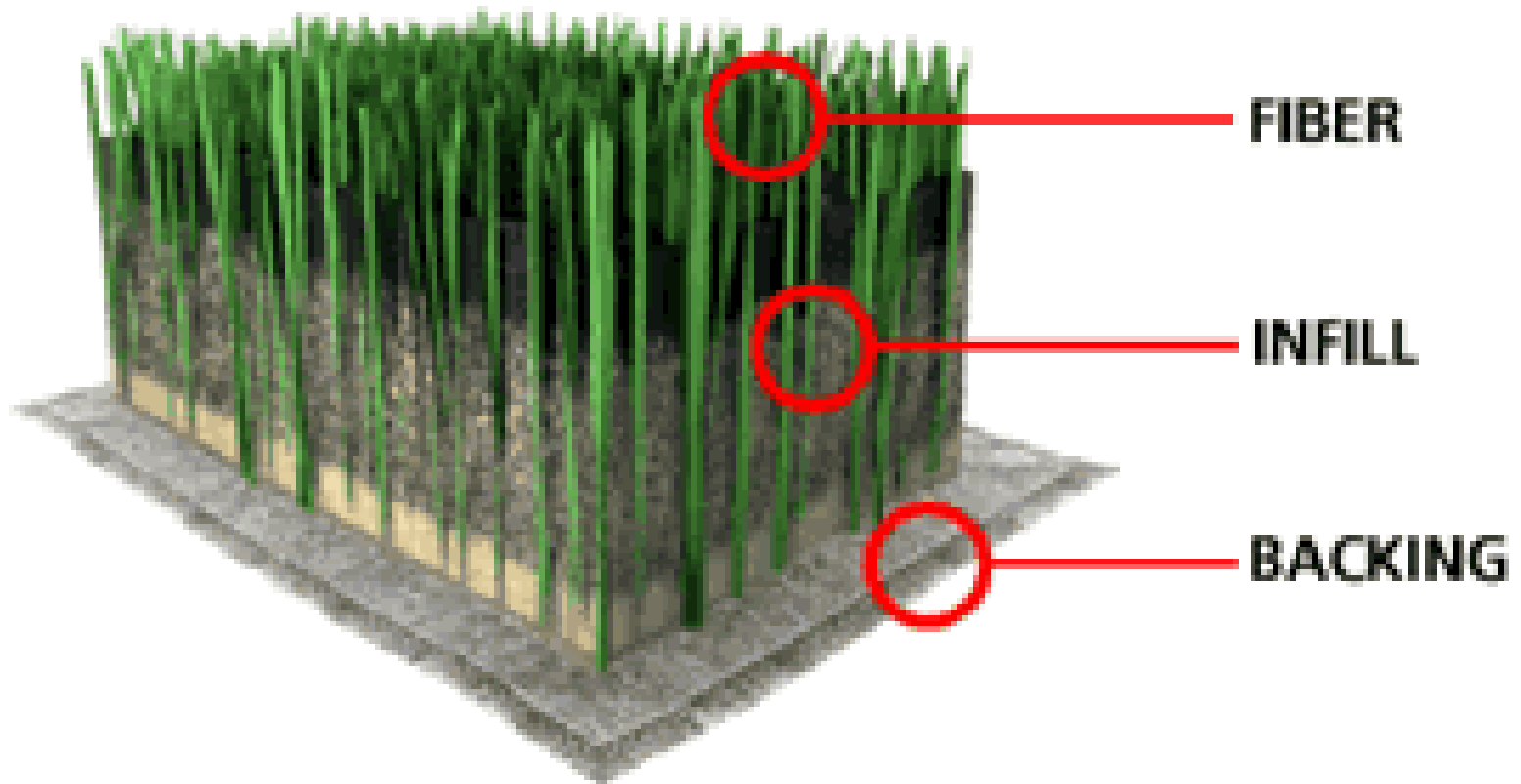
Scrap Tire Utilization in Europe



25 Million Tires Annually From Tires to Turf



Synthetic Turf



Contribution of Synthetic Turf Industry to National Scrap Tire Problems

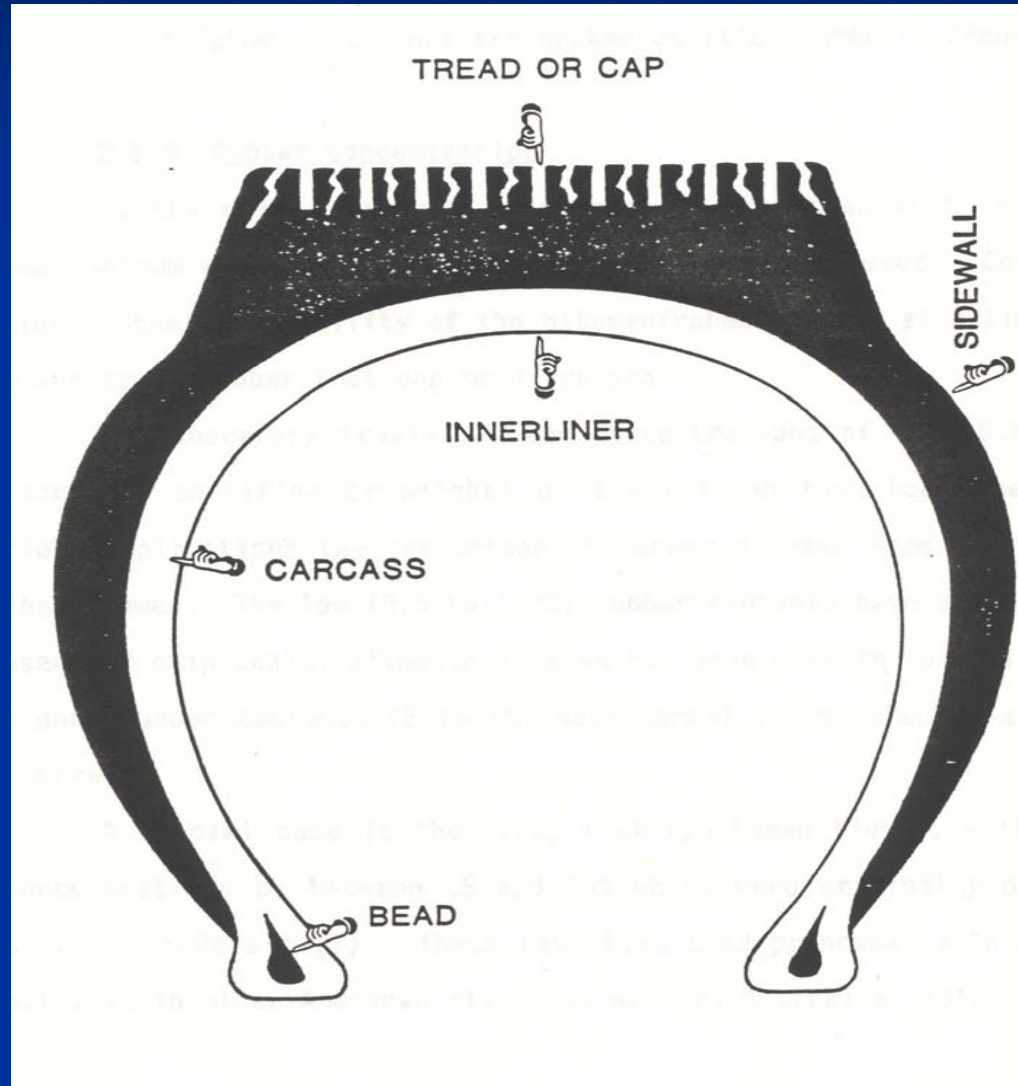
- ❖ 25,000 scrap tires utilized in one field
- ❖ Based on 1,200 fields annually, this industry recycles 25 million scrap tires
- ❖ Over 10% of the annual scrap tires generated are recycled by this industry
- ❖ Over \$300 million dollars are collected from the public annually for scrap tire management programs
- ❖ Synthetic turf industry has not received appropriate recognition

Crumb Rubber Production Methods

Types of Processes

- ❖ Ambient Processing
- ❖ Cryogenic Processing

Cross Section Of a Passenger Tire



CRM Ambient Production Method

1. Shredding Department
2. Granulation Department
3. Grinding Department

Shredding Department



Primary Granulation 2 Inch Chips Being Reduced to $\frac{3}{4}$ Inch While Separating Steel



Secondary Granulation $\frac{3}{4}$ Inch Being Reduced to $\frac{3}{8}$ Inch While Separating Fabric and Steel



Grinding Department



Air Control System



Fine Grinding and Sizing



Finished Product and Bagging



Cryogenic Crumb Rubber Production Method



Processing Steps

1. Shredding
2. Granulation
3. Cryogenic Crumb Rubber Production
4. Fiber and Wire Separation
5. Drying, Classification & Bagging

Cryogenic Production Line



1. Shredding Department

- ❖ Passenger and truck tires are shredded into 2 inch (nominal size) shred.
- ❖ Over size tire shreds are returned to the shredder for further processing.
- ❖ In this department the whole passenger and truck tires are shredded at the rate of 600 tires per hour.



2. Granulation Department

- ❖ The 2 inch tire shred is fed into the primary granulator.
- ❖ Primary granulator reduces the tire shred into 1 inch nominal granulated tire rubber.
- ❖ The wire is separated from granulated tire rubber by magnetic devices.
- ❖ The granulated tire rubber is %95 free of wire.





4. Fiber and Wire Separation

- ❖ The cryogenically produced crumb rubber passes through a screen at the bottom of each mill is transferred to the primary screen.
- ❖ The liberated fiber are collected by a vacuum system.
- ❖ The liberated wire are separated by magnetic devices.
- ❖ The clean cryogenically produced crumb rubber particles are transferred to the drying chamber.



5. Drying, Classification & Bagging

- ❖ The cryogenically produced crumb rubber is introduced into the rotating dryer which produces 99.9 percent moisture free crumb rubber.
- ❖ The dried crumb rubber is transferred to a four stage shaker screener to produce four different size of products.
- ❖ Each product is transferred pneumatically to bagging station.
- ❖ The products are bagged in 2,000 pounds weather proof super sacks.



Technical Aspects and Effects of Rubber Particles in Asphalt Pavements

"GREENBOOK"
Standard
Specifications
for
Public Works
Construction

2000 Edition

ARIZONA
DEPARTMENT OF TRANSPORTATION

**STANDARD
SPECIFICATIONS**
for
**ROAD AND BRIDGE
CONSTRUCTION**



2000

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

**STANDARD
SPECIFICATIONS**
JULY 1999



Scrap Tire To High Natural Rubber CRM Ratio

- ☑ *75% scrap tire CRM*
- ☑ *25% high natural rubber CRM*

Grading Requirements For CRM

Sieve Size	Scrap Tire CRM Passing (%)	High Natural CRM Passing (%)
No. 8	100	100
No. 10	98 – 100	100
No. 16	45 – 75	95 – 100
No. 30	2 – 20	35 – 85
No. 50	0 – 6	10 – 30
No. 100	0 – 2	0 – 4
No. 200	—	0 – 1

Chemical Requirement For High Natural Rubber CRM

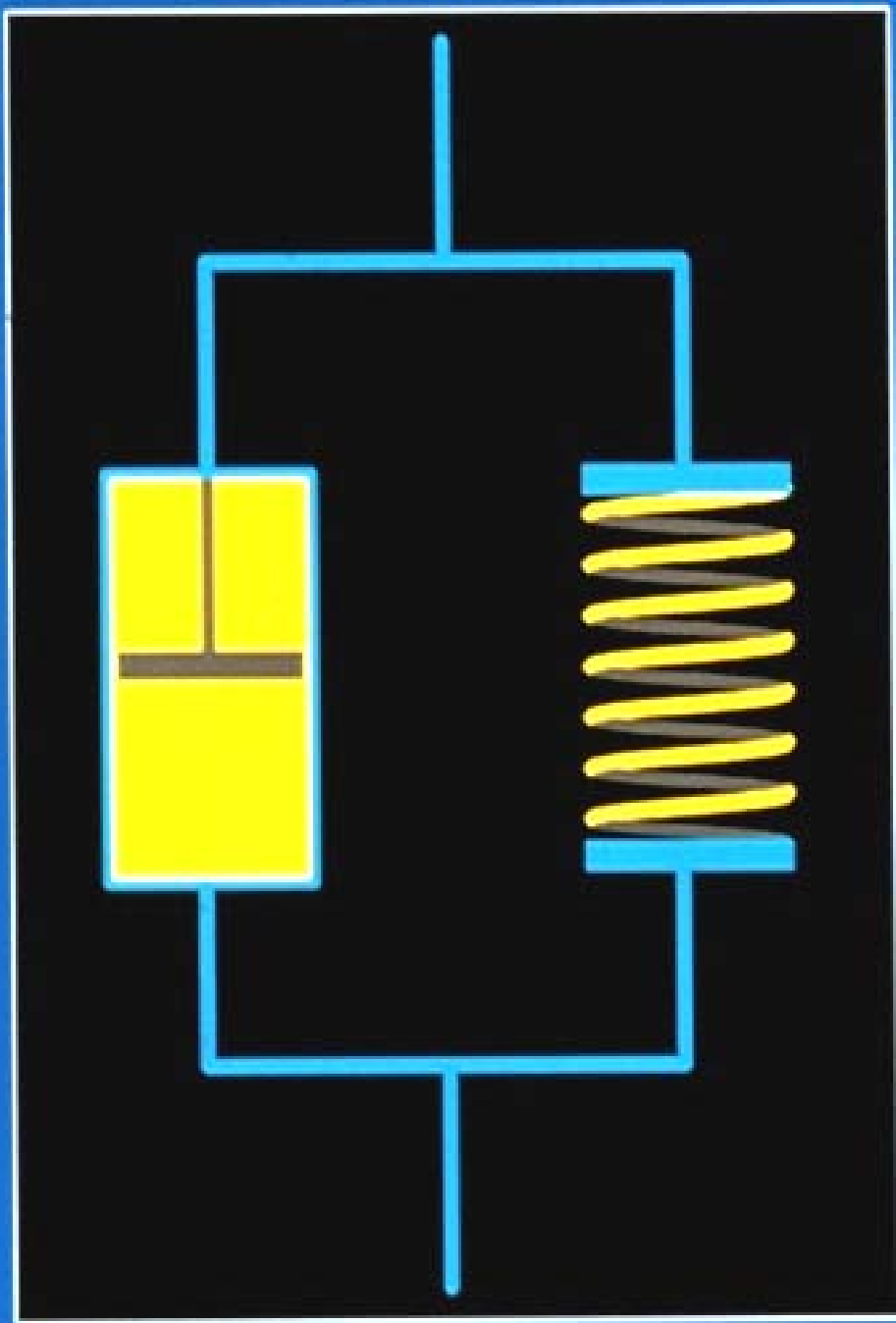
Test	Minimum	Maximum
Acetone Extract	4.0 %	16.0 %
Rubber Hydro Carbons	50.0%	—
Natural Rubber Content	40.0 %	48.0 %

Effect of Visco-Elastic Properties of Crumb Rubber on Asphalt-Rubber Pavement

- Durability
- Fatigue Life
- Permanent Deformation

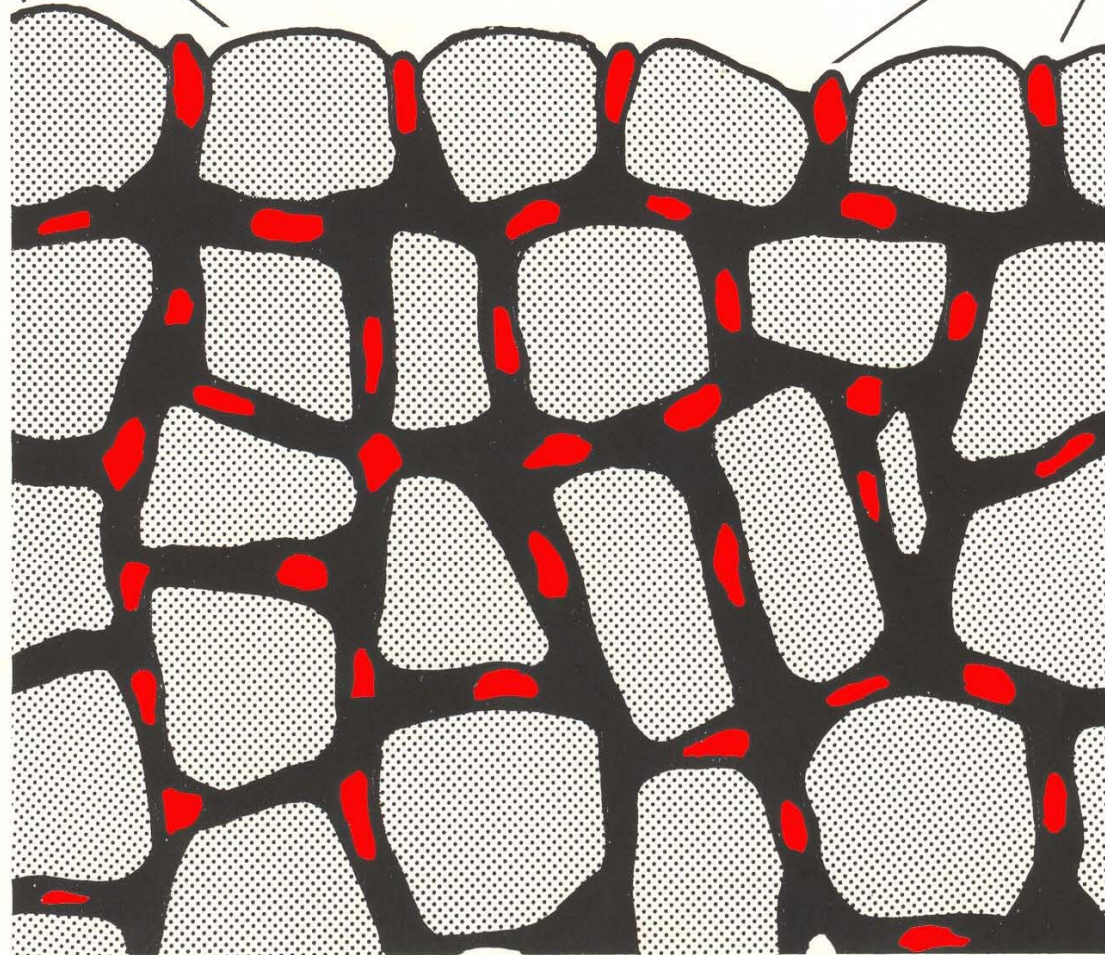
VISCO-

ELASTIC

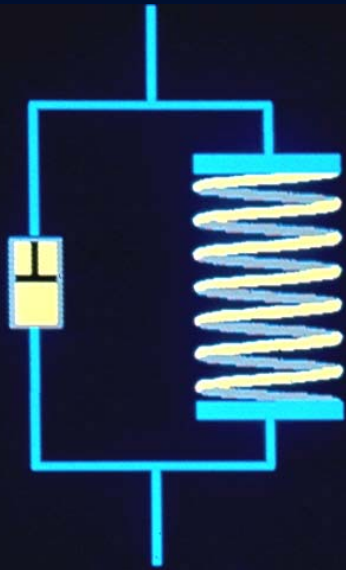


Gap Graded Aggregate

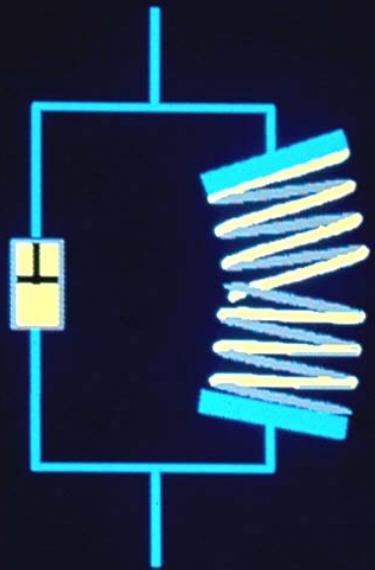
Rubber Granules



COLD

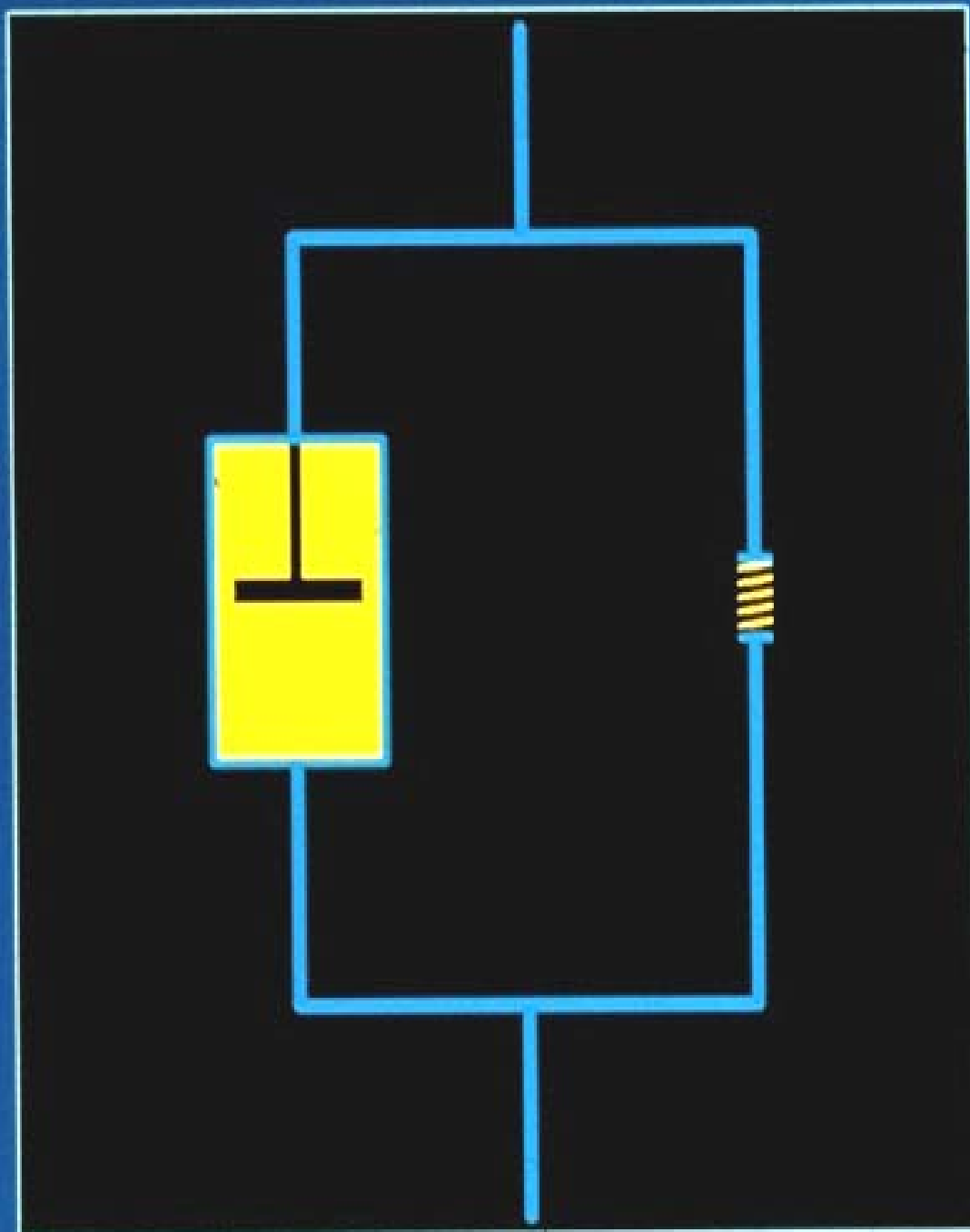


COLD





HOT





SHOVING

Extraction Of Crumb Rubber From Asphalt Binder



Recovered Crumb Rubber



Crumb Rubber Gradation Analysis Method



Effect of Crumb Rubber on Pavement Compaction



Effect of Crumb Rubber Quality on Finished Pavement Surfaces



Inspection of Asphalt Rubber Surface Prior Compaction



Every Mile of Asphalt Rubber Road Recycles 4000 Waste Tires



Questions ?

