

Interim Update – NHTSA Tire Aging Test Development Project

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Statistics: N. American Tire Industry

- 2003 - North American tire sales:
 - ≡ \$23.5 Billion
- 2003 - NA passenger & LT tires shipped:
 - ≡ 291 million (798,000/day)
- Average passenger tire service life:
 - ≡ 2002: 44,700 miles / 3.7 years
 - ≡ 2003: **46,300 miles / 3.8 years**
 - +1,600 miles of average service life added last year
 - Large distributions in average service lives

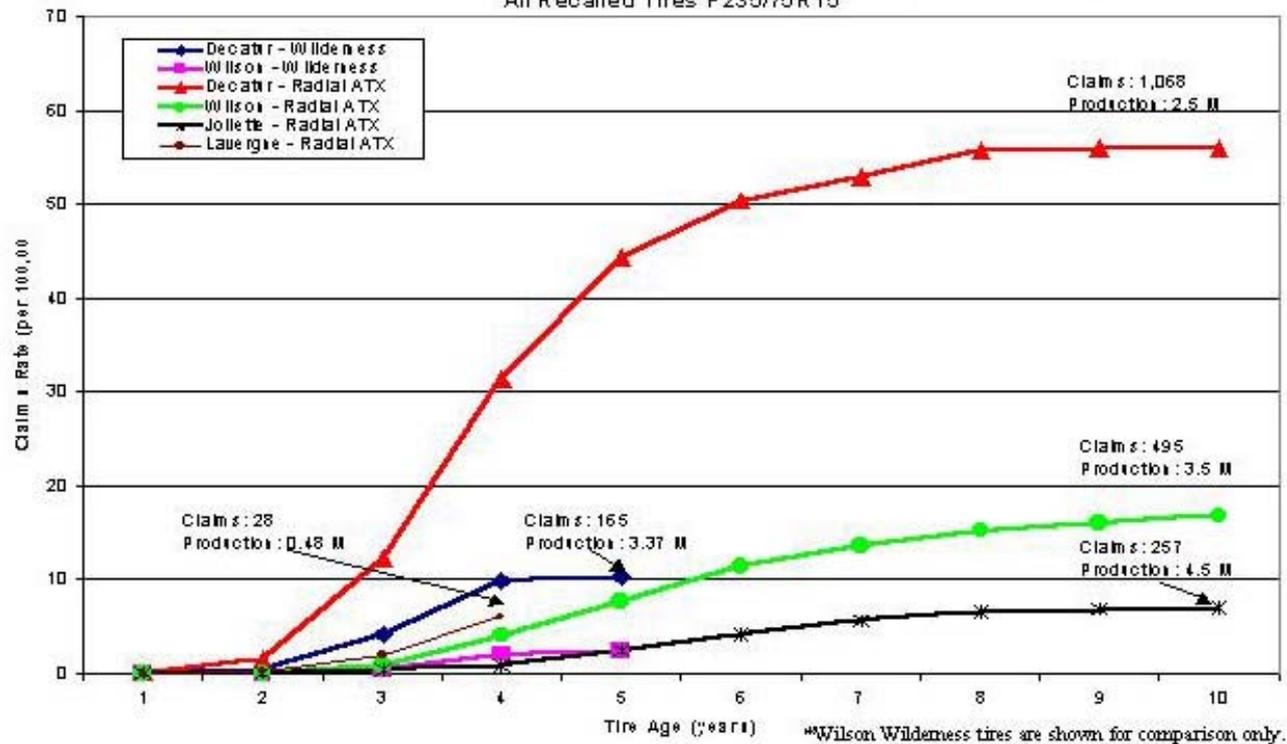
Tire Aging Project Background

#13

Tread Separation Rate (service condition): Recalled Tires Only*

Cumulative Claim Rates - Tread Separation (Serv. Cond.)

All Recalled Tires P235/75R15



Tire Aging Project Background

- Summary - The agency has noted that:
 - ≡ Tire service life is increasing
 - ≡ States with high average ambient temperatures have higher tire failure rates
 - ≡ Tire failures often don't manifest until many years of use
 - ≡ Testing new tires from the factory may not identify defective designs

Tire Aging Project Basics



Quantify How Tires Age During Use in High Ambient Temperature Regions

Basic Approach: Compare tires collected from on-vehicle use in a southern state to new versions of themselves to quantify the amount of degradation that occurs with age & use

Tire Model Selection Requirements

- Production Availability

- ≡ In production 1998 to 2003

- Popularity

- ≡ OE: Must have been OE on at least one US vehicle

- ≡ Replacement: Must be available at a large tire retailer

- Design Legacy

- ≡ **No 'major' design changes from 98 – 03**

NHTSA Field Tire Collection

■ Field Tire Collection

≡ Stated Goal:

- 12 tire models
- 60 of each model
- 20 in each age group 1: 97-98, 2: 99-00, 3: 01-03

■ Original Equipment

≡ P-metric tires

- Compact car
- Mid-size car
- Mid-size SUV
- Large SUV

■ Replacement Brand

≡ P-metric tires

- Mid-size car
- Full-size car
- Large SUV

≡ Light Truck

- Load Range E

NHTSA Field Tire Collection

Collection Area: Maricopa County (Phoenix), Arizona

- ⌘ Average annual temperature 72.9°F (22.7°C)
- ⌘ The state of Arizona had the highest per capita tire tread separation rate for the recalled Firestone tires
- ⌘ Maricopa County population: 3,072,149 (2000 U.S. Census)



Storage Warehouse



Refrigerated Trailers

Phase I Test Tires

■ Field Collection

- ≡ Completed March, 2003
- ≡ Collected 600+ tires off of Phoenix area vehicles
- ≡ The six tire models (out of 12) with the best distribution of tires were selected for Phase I

Type	Size	Load Index	Speed Rating	Brand	Model
P-metric	P195/65R15	89	S	BFGoodrich	Touring T/A
P-metric	P205/65R15	92	V	Goodyear	Eagle GA
P-metric	P235/75R15	108*	S	Michelin	LTX M/S
Metric	255/65R16	109	H	General	Grabber ST A/S
P-metric	P265/75R16	114	S	Firestone	Wilderness AT
LT	LT245/75R16/E	120**	Q	Pathfinder	ATR A/S OWL

*Extra Load / **Load Range E

Phase I New and Used Tire Tests

Component Properties

- Microscopy
- Innerliner Air Permeability (21°C & 70°C)*
- Peel Strength (23°C & 100°C)
- Variable Speed Peel Strength
- Total Crosslink Density
- Crosslink Density Distribution
- Fixed Oxygen by Weight
- Tensile Properties
- Shore Hardness
- Innerliner Compound (FTIR, TGA)*
- Micro Demattia
- Torsional Test on Belt Ply
- Two-ply Laminate Fatigue
- Pure Shear Crack Growth
- Interlaminar Shear

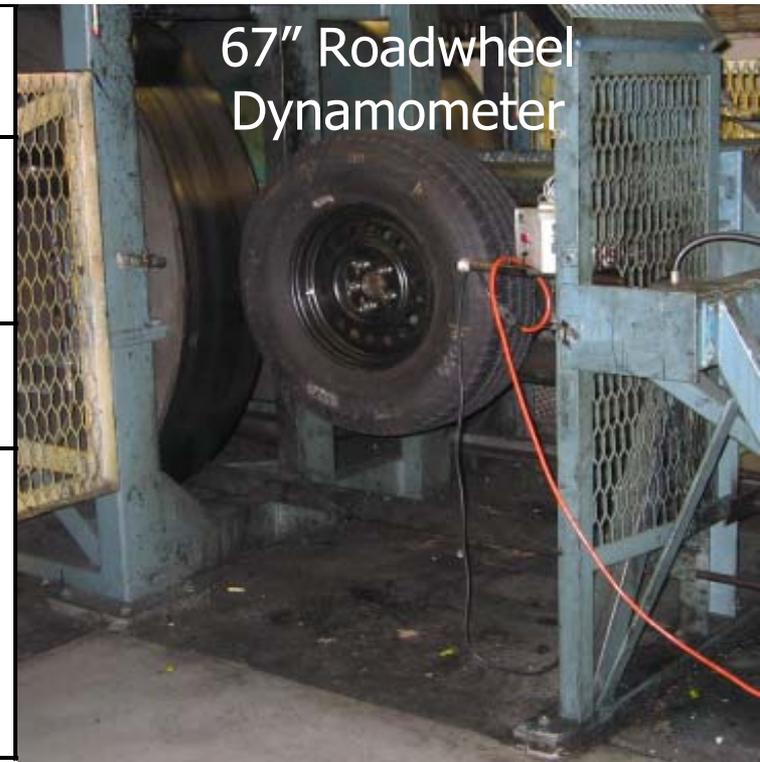
Whole Tire Properties

- Air Permeability(21°C & 70°C)*
- Shearography
- Stepped-Up Load Resistance
- Stepped-Up Speed Resistance
- Intra-carcass Pressure*
- Tread Depth

Example Test Method

Stepped-Up Load to Failure Test - Based on the FMVSS 139 Endurance Test, New & Used Tires

Test Stage (#)	Duration (hours)	Percent Max Load	Speed (mph)	Test
1	4	85%	75	<i>FMVSS 139 Endurance</i>
2	6	90%	75	
3	24	100%	75	
Inspection	1	-	-	-
4	4	110%	75	<i>Stepped-Up Load to Catastrophic Failure</i>
5	4	120%	75	
Etc.	4	+10% every 4 hours	75	



Example Test Method

- Stepped-Up Load to Failure - Roadwheel Dynamometer Test
 - ≡ Tires underwent detailed pre-test visual inspection
 - No visible defects or repairs (patches, plugs, exposed belt edge, etc.) were allowed
 - ≡ Tires underwent full pre-test bead to bead shearography evaluation
 - No excessive shearography separation (indicative of damage/abuse) was allowed
 - ≡ Spare tires separated out
 - ≡ Time to failure results plotted against age, mileage, treadwear, etc.

Example Test Method

Roadwheel Removal Conditions



Example Test Method

Preliminary Findings – Stepped-Up Load to Failure Test:

- New versions of the six tire models did very well in the stepped-up load test
- Tires collected from use in Phoenix, Arizona exhibited a degradation in performance, many significantly, with age & use
- Tires from of different makes/models degraded at different rates
- Tires from different service applications degraded at different rates

Evaluate the Effectiveness of Proposed Tire Aging Methods

Basic Approach: Compare testing results using current new tire aging methods to real world tire data

Project Requirements

- § 571.139 Standard No. 139; New pneumatic radial tires for light vehicles
 - ≡ Tire aging test was deferred for further development in the June 2003 final rule
 - ≡ A NPRM for a tire aging test is anticipated in 2005
 - ≡ The FMVSS 139 goes into effect June 1, 2007

Aging Tests Being Evaluated

Aging Tests Currently Being Evaluated:

- ⌘ ASTM - Air Permeability (F1112-00)
- ⌘ Continental General - P-END
- ⌘ Ford - Hybrid Oven/Roadwheel Aging
- ⌘ Michelin - Long Term Durability Endurance (LTDE)

Aging Tests Not Being Evaluated:

- ⌘ General Motors - Accelerated Tire Endurance (ATE)
- ⌘ NHTSA - Roadwheel Conditioning & Peel Force (NPRM FMVSS 139)

Tentative Tire Aging Project Schedule

Meet with Industry / Project Planning	Complete
Tire Collection in Phoenix, Arizona	Complete
Analysis & Testing of Field Tires	10/03 - 10/04
Evaluation of Tire Aging Methods	10/03 - 10/04
Tire Aging Test Development	10/04 - 6/05

Tire Aging Project Data and Findings

- The agency anticipates publishing a final report and releasing the data in conjunction with the issuance of the FVMSS 139 Tire Aging Test NPRM
- All data, pictures, graphs, etc. from the project are being organized in a searchable digital database. The goal is to make this database available to the public once finalized