Tire Aging:

A Summary of NHTSA's Work

Background

- Tire aging refers to the reduction or loss in a tire's material properties, which over time leads to a reduction of its performance capabilities.

  ✓Aged tires are prone to failure

  ✓Result of failure is potential loss of vehicle control

  ✓Tire aging occurs whether a tire is driven or not

Background

- The mechanisms that occur in a tire that are most likely to affect the safety of a tire are:

  - ✓ Chemical aging occurs in a tire due to combined effect of heat and oxygen (Thermo-oxidative degradation).
  - ✓ Mechanical aging results from stresses and strains that a tire incurs during normal use.

- The thermo-oxidative degradation is accelerated with higher temperatures and is a contributing factor for tire failures.

- Tire aging failures tend to occur :

  - ✓ the high heat states
  - ✓ the summer months
  - ✓ during the day
  - ✓ while the vehicle is being driven at highway speeds

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Safety Problem

- ✓ 2005-2007 data including databases (NMVCCS, GES, CDS) showed 90 fatalities and over 3,200 injuries were probably caused by tire aging or where tire aging was a significant factor.

- ✓ 2007-2010 NASS-CDS data from tire related crashes compared to 1995-2006 data shows a 35% reduction in tire crashes, a 50% reduction in fatalities and a 42% reduction in injuries.

Table 1: Light Vehicle Tire-related Crashes, Fatalities and Injuries (Annual Averages)

NASS-CDS	1995-2006	2007-2010
Tire Crashes	17,019	11,047
Fatalities	386	195
Injuries	11,005	6,361

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Congressional Interest

- TREAD Act of 2000 required NHTSA to revise and update FMVSS No. 109, *New pneumatic and certain specialty tires*, among other things.

  ✓ Members of Congress suggested that the agency consider the feasibility of including an aging test.

- In the 2003 Final Rule for the new FMVSS No.139, NHTSA deferred action on the 2002 NPRM proposal to add an aging test to the new tire Standard until further research was conducted.

- SAFETEA-LU of 2005 directed NHTSA to develop a Report to Congress on tire aging that was submitted in August 2007.

- Letters from the Congress continue.

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Tire Aging Project

- NHTSA started the Tire Aging Test Development project in 2002. The main goals of the project were:

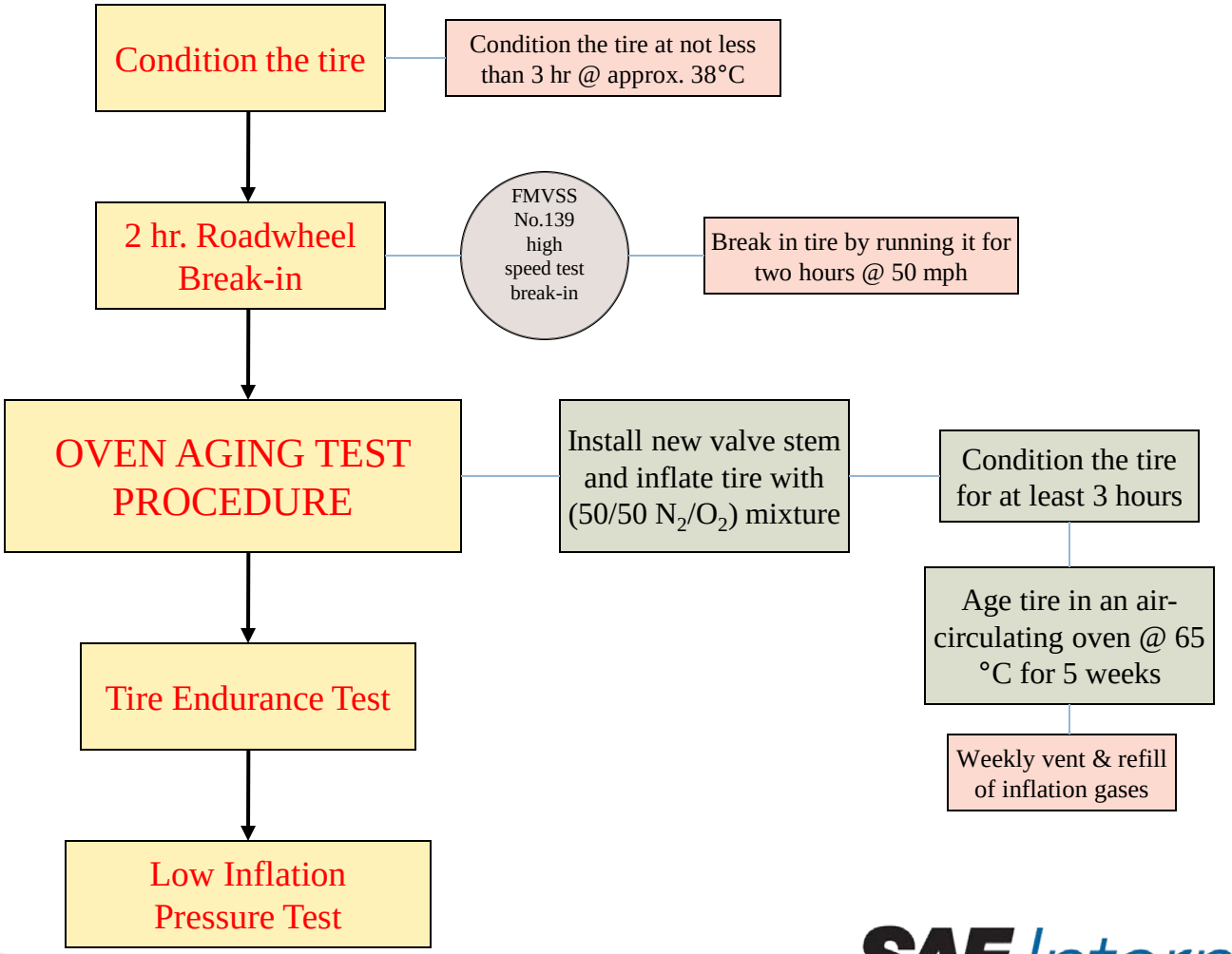
  ✓ Gain a better understanding of service-related tire degradation overtime.

  ✓ Develop an accelerated tire aging test protocol that would simulate several years of service in regions of the US with high average ambient temperatures.

Major Technical Considerations

- Study how tires aged while in service by testing their performance and material properties.
- Development of a laboratory tire aging test that simulates real-world tire aging.
- Tire aging test procedure refinement.
- Validation of test procedure with pre-FMVSS 139 tires.
- Validation of test procedure with 139-compliant tires.

OVEN AGING TEST



Validation Testing Highlights

Pre-139 Update

- Passenger car and light truck tires were aged for 3, 4 and 5 weeks.
- OE and replacement tires were tested.
- Passenger car tires maintained material properties and roadwheel performance better than the light truck tires (FMVSS No. 119-compliant).
- Failure modes: belt edge separation, separation between belts, loss of tread and belt, tread element tear/chunk out, innerliner detachment, sidewall split and rupture, white sidewall separation, tread and belt separation, black sidewall separation.

Post-139 Update

- Passenger car and light truck tires were aged for 5 weeks.
- Only replacement tires were tested.
- FMVSS No.139-compliant tires were tested, both passenger car tires and light truck tires.
- Failure modes: Cracking in the shoulder, cracking in tread groove, cracking in base of tread at shoulder, tread separation at shoulder. Smaller percentages of tread shoulder blister, tread chunking, cracking in sidewall, sidewall delamination, sidewall bubbles, sidewall deformation at splice.

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Pre-139 Update Results

Belt edge separation

Loss of tread and belt

Tread and belt separation

Black sidewall separation

Innerliner detachment

Sidewall split and rupture

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Pre-139 Update Results

Tread element tear

White sidewall separation

Separation between belts

Post-139 Update Results

Tread separation at shoulder

Cracking in shoulder

Tread shoulder cracking out of oven

Cracking in tread groove

Cracking at base of tread shoulder

Sidewall bubbles

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Final Observations

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- FMVSS No.139-compliant tires are showing failure modes after being subjected to our tire aging protocol.
- Failure modes are less severe than the ones observed in Pre-FMVSS No. 139 tires after endurance and low pressure test.
- Oven-aged FMVSS No. 139-compliant tires are more resistant to degradation than oven-aged pre-FMVSS No.139 tires.

Summary of Agency's Work

- NHTSA research data shows that tire aging can present a safety problem particularly in the high heat states.
- Artificially aging a tire in a laboratory oven is a scientifically valid method to accelerate the tire aging process and to simulate a naturally aged tire in service on a vehicle.
- Our oven aging protocol approximates the aging experienced by a tire with four years of service in Phoenix, Arizona.
- Our research suggest that oven-aged FMVSS No. 139-compliant tires are more resistant to degradation than oven-aged pre-FMVSS No. 139 tires.
- Light vehicle tires are performing better on the road as reflected in our most recent crash data.

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Tire Aging Information

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- Visit our Tire Aging Docket No: NHTSA-2005-21276 at **www.regulations.gov**

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Thank you!