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Tire Efficiency Consumer Information:

- RRC versus RRF
- RMA Rating System Proposal

California Energy Commission Staff Workshop

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Requirements of AB844 (25771)

A. Develop a database of the energy efficiency of a representative sample of tires sold in the state.

B. Develop a rating system based upon the data collected in (A) for the energy efficiency of replacement tires sold in the state that will enable consumers to make informed decisions when purchasing tires for their vehicles.

C. Based upon the test procedures pursuant to (A) and the rating system pursuant to (B), Develop requirements for tire manufacturers to report to the commission the energy efficiency of replacement tires sold in the state.

What Makes a Good Rating System?

Criteria for Rating System

- Is it easy to understand?
- Does it offer all consumers a choice among products appropriate for their vehicle?
- Does it lead consumers to suggest a tire choice that is appropriate for their vehicle?
- Can it provide information about potential efficiency?
- Is additional information provided (Safety, Durability, Etc.) relating potential tire performance trade-offs?
- Does it foster competition among tire manufacturers to improve tire efficiency?

Basis for Rating System

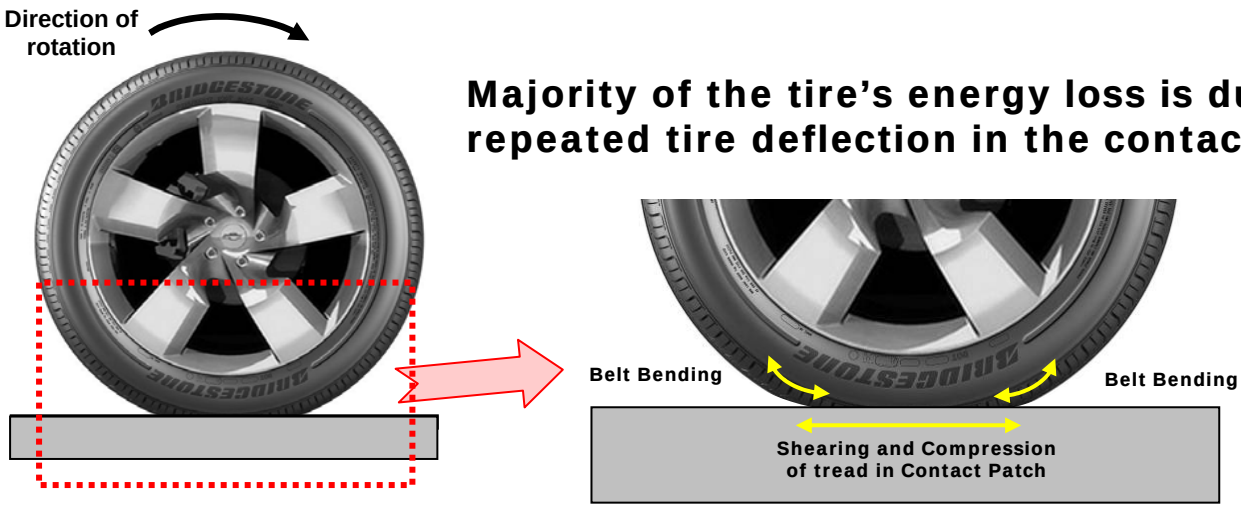
- Options for Rating System Basis:
  - Rolling Resistance Coefficient (RRC)
  - Rolling Resistance Force (RRF)

Rolling Resistance:

Rolling Resistance: The Energy dissipated by a tire per unit of distance traveled

Rolling Resistance Force (RRF): The Force (Fx) at the axle in the direction of travel required to make a tire roll under a specific Load (Fz), Speed and Inflation Pressure

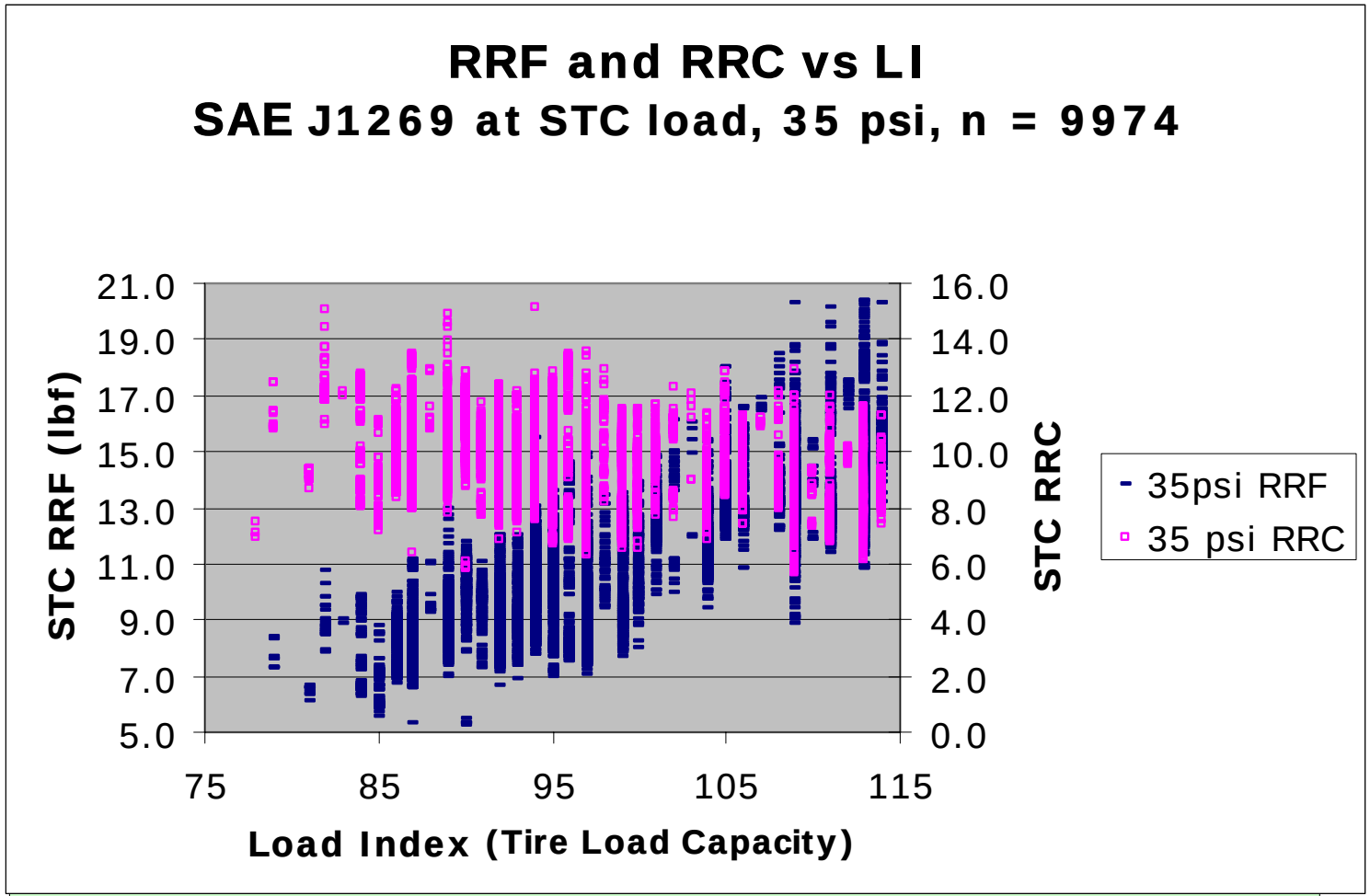
$$\text{Rolling Resistance Coefficient (RRC)} = \frac{\text{Rolling Resistance Force (RRF: Fx)}}{\text{Radial Load (Fz)}}$$



Majority of the tire’s energy loss is due to repeated tire deflection in the contact patch

RRC Versus RRF:

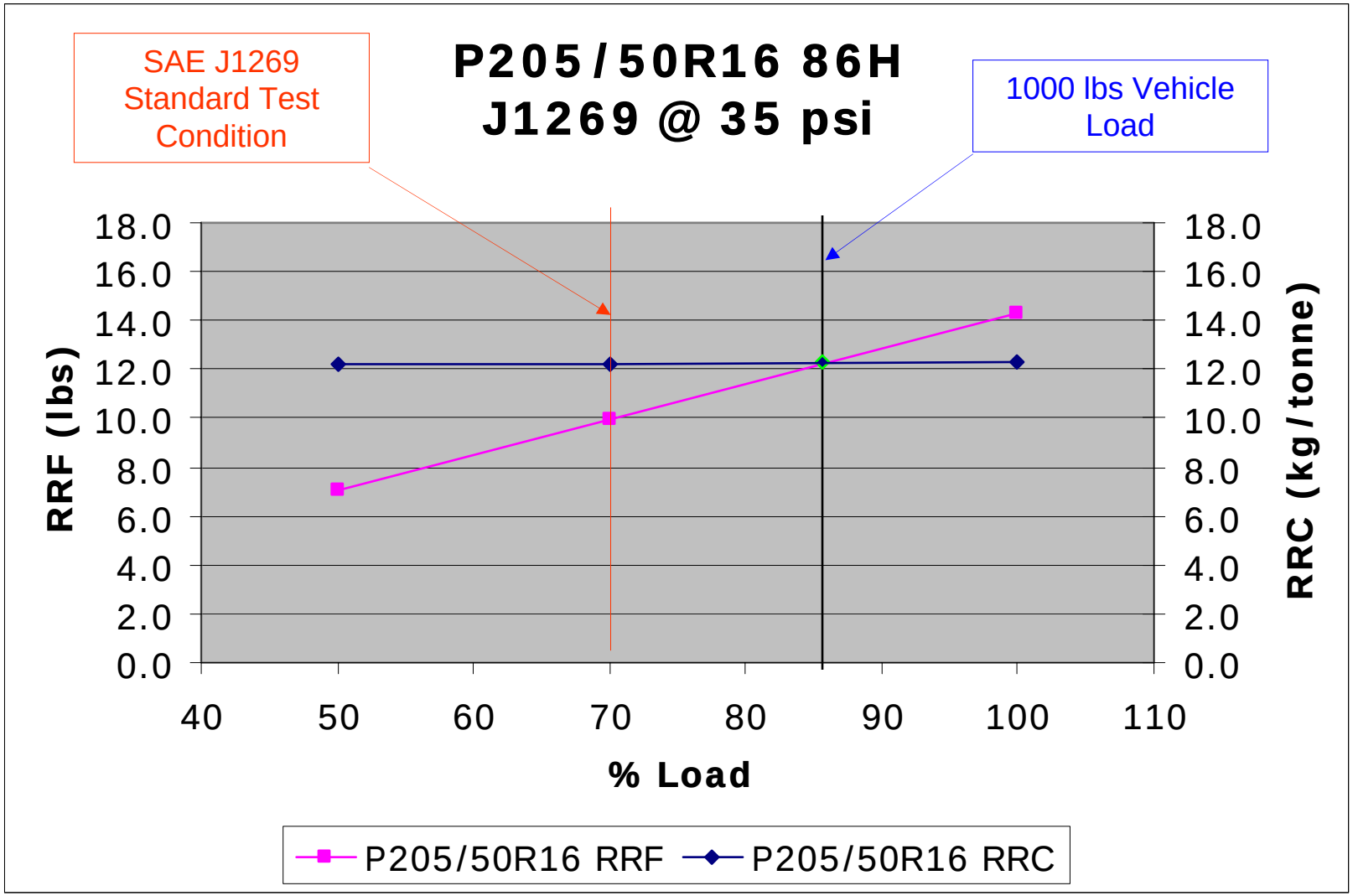
RRC and RRF versus Tire Load Capacity (Load Index):



RRC is relatively insensitive to Load Index. RRF is highly sensitive to Load Index.

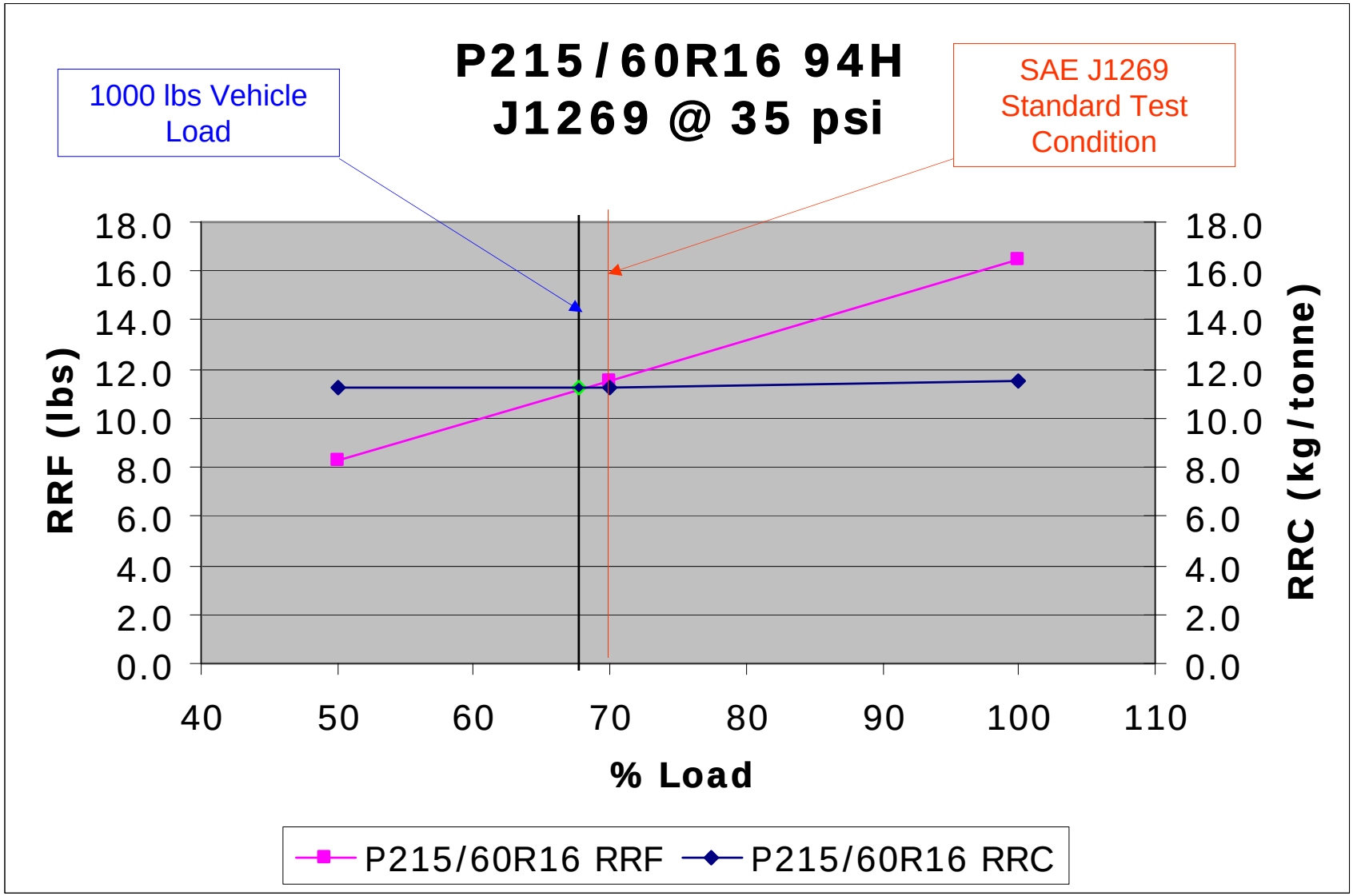
RRC Versus RRF:

Specific Case #1: P205/50R16 RRF vs. RRC:



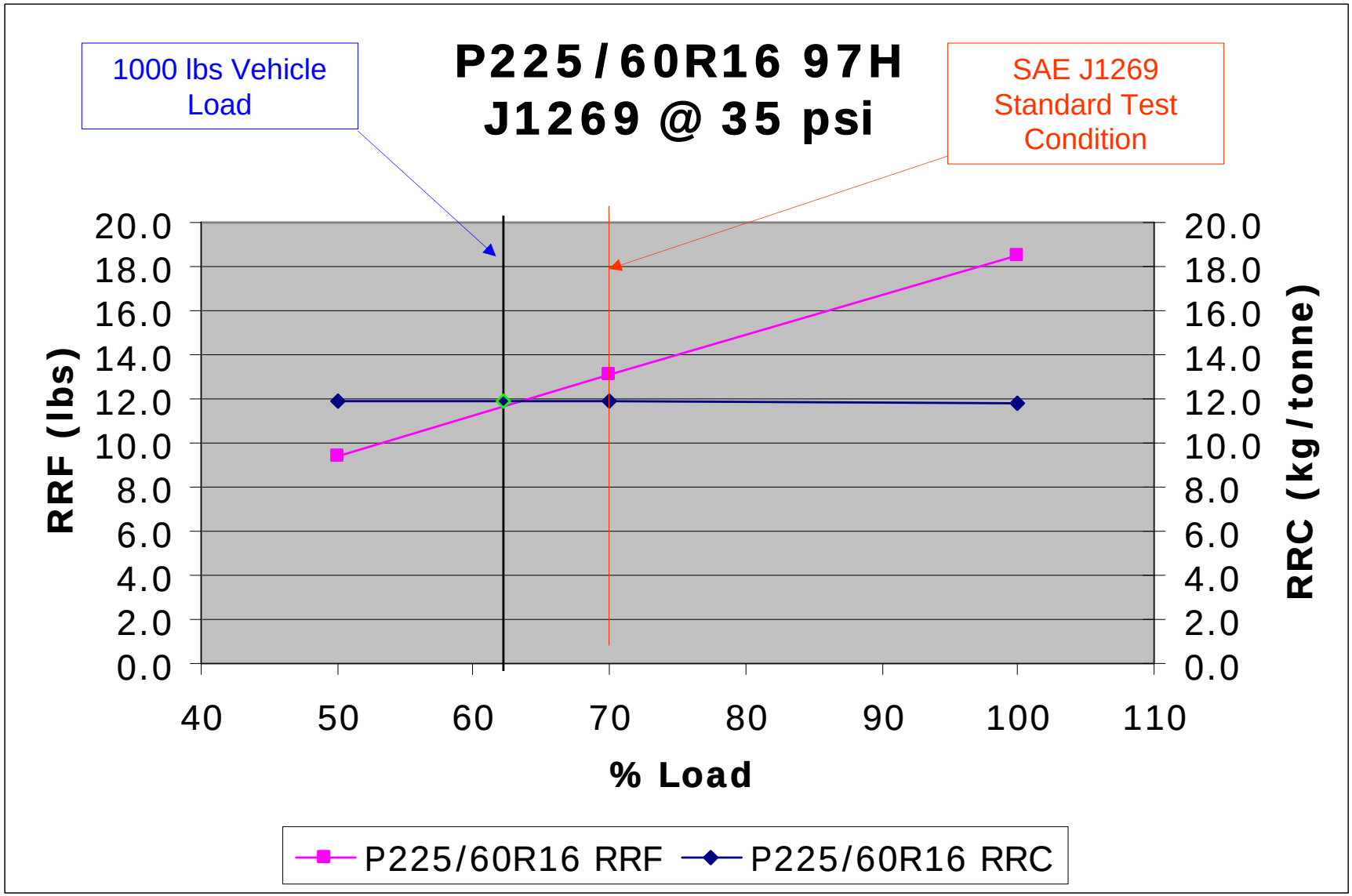
RRC Versus RRF:

Specific Case #2: P215/60R16 RRF vs. RRC:



RRC Versus RRF:

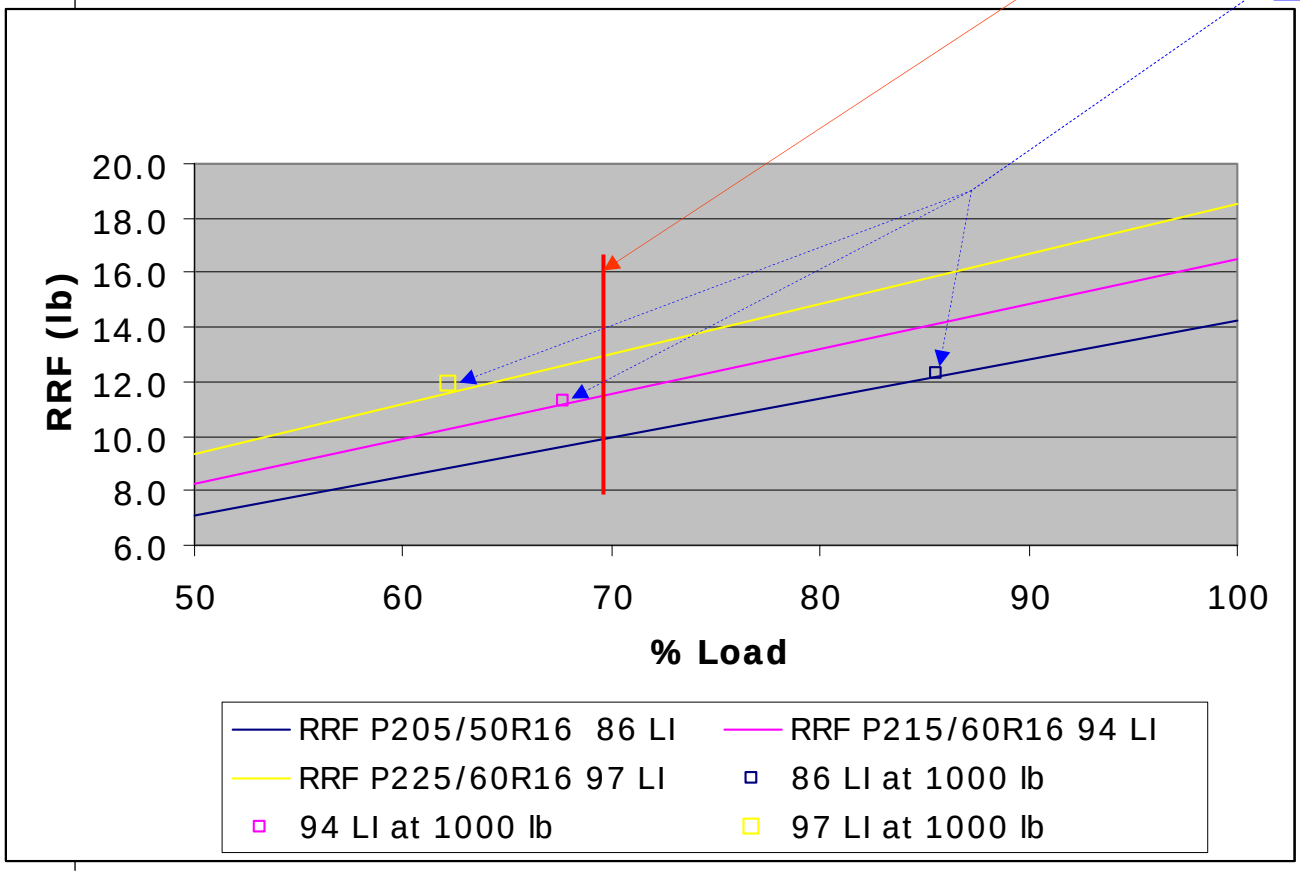
Specific Case #3: P255/60R16 RRF vs. RRC:



RRC Versus RRF:

Case Study #1:

TIRE_SIZE	LOAD_INDEX	Max Load	STDTIRENAMES	RRF Based Proposal: SAE J1269 RRF — RRF at 70% Load	Applying all tires on the same vehicle — RRF at 1,000 lb vehicle load	RMA Proposal: SAE J1269 RRC — RRC at 70% load (kg/tonne)
P205/50R16	86	**1168**	FIREHAWK GTA 03	9.93	12.29	12.24
P215/60R16	94	**1477**	FIREHAWK LH	11.54	11.28	11.28
P225/60R16	97	**1609**	FR440	13.06	11.87	11.85



RRC is a better rank order predictor for consumers

RRC at 70% Load is a good rank order predictor for RRF at a given vehicle load over a large range of Load Indexes

Note: All data is per the SAE J1269 procedure at 35 psi

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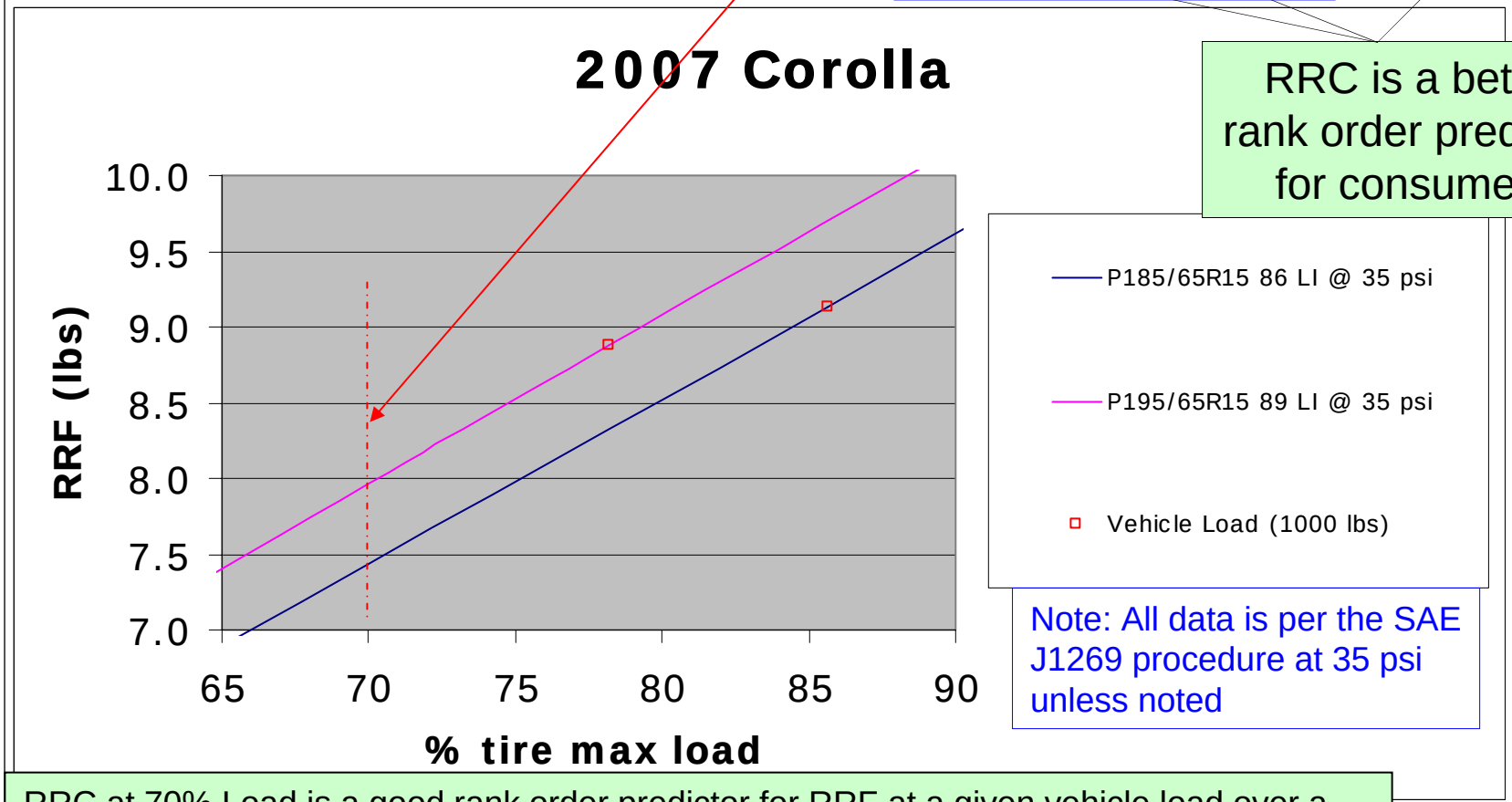
RRC Versus RRF:

Case Study #2:

TIRE_SIZE	LOAD_INDEX	Max Load	STD TIRE NAMES	RRF Based Proposal SAE J1269 RRF(lbs) @70% Load	Applying Both Tires to Same Vehicle: SAE J1269 RRF (lbs) @ 1000# load &35 psi	Applying Both Tires to Same Vehicle: SAE J1269 RRF (lbs) @ 1000# load &30 psi	RMA Proposal: SAE J1269 RRC at 70% load (kg/tonne)
P185/65R15	86	1168	TURANZA T	7.43	9.14	9.73	9.09
P195/65R15	89	1279	AFFINITY TOURING T2	7.97	8.88	9.55	8.90

RRC is a better rank order predictor for consumers



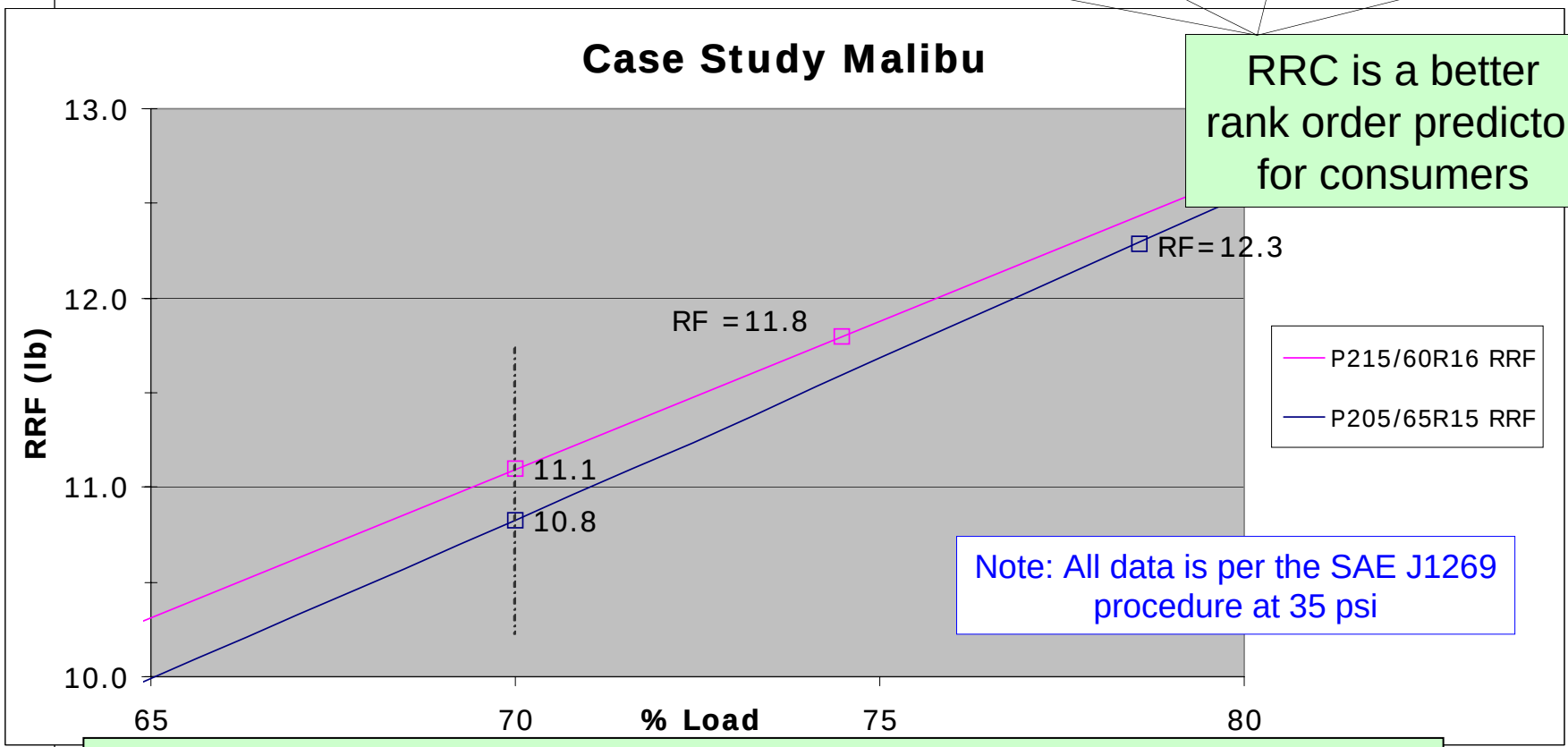
Note: All data is per the SAE J1269 procedure at 35 psi unless noted

RRC at 70% Load is a good rank order predictor for RRF at a given vehicle load over a large range of Load Indexes

RRC Versus RRF:

Case Study #3:

TIRE_SIZE	LOAD_INDEX	Max Load	STDTIRENAMES	RRF Based Proposal: SAE J1269 RRF at 70% Load	Applying All Tires to Same Vehicle: SAE J1269 RRF @ RF position load	Applying All Tires to Same Vehicle: SAE J1269 RRF at 1,000 lb vehicle load	Applying All Tires to Same Vehicle: SAE J1269 RRF at 1,200 lb vehicle load	RMA Proposal: SAE J1269 RRC at 70% load (kg/tonne)
P205/65R15	92	1400	BS TURANZA EL42	10.83	12.29	11.07	13.50	11.05
P215/60R16	94	1477	AFFINITY TOURING T3	11.10	11.80	10.74	12.86	10.74



RRC is a better rank order predictor for consumers

Note: All data is per the SAE J1269 procedure at 35 psi

RRC at 70% Load is a good rank order predictor for RRF at a given vehicle load over a large range of Load Indexes

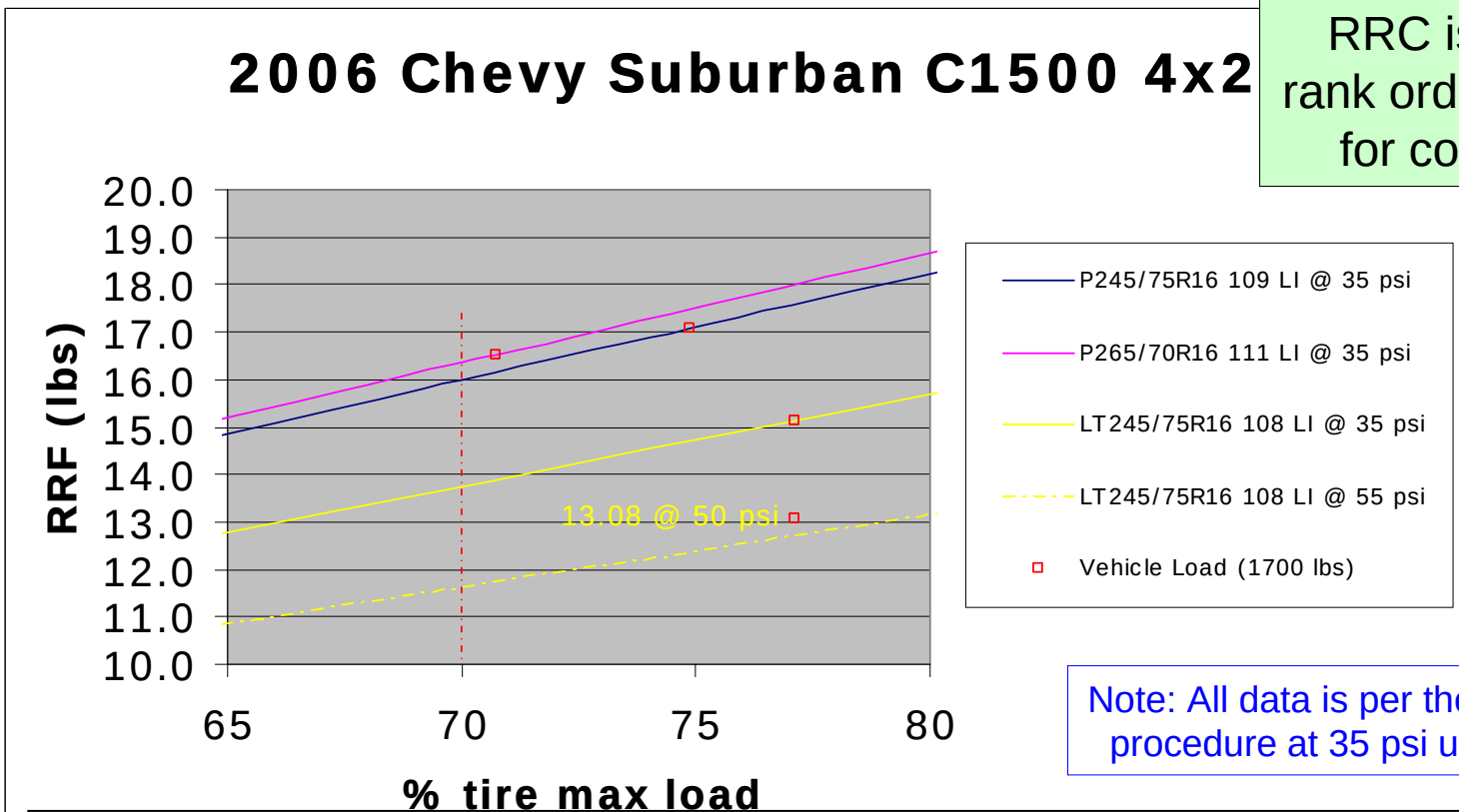
RRC Versus RRF:

Case Study #4:

TIRE_SIZE	LOAD_INDEX	Max Load	STDTIRENAMES	RRF Based Proposal: SAE J1269 RRF(lbs) @70% Load	Applying All Tires to Same Vehicle: SAE J1269 RRF (lbs) @ 1700# load &35 psi	Applying All Tires to Same Vehicle: SAE J1269 RRF (lbs) @ 1700# load &50 psi	RMA Proposal: SAE J1269 RRC at 70% load (kg/tonne)
P245/75R16	109	2065 lbs*	Wilderness HT IV	15.98 @ 35psi	17.08	NA	10.05
P265/70R16	111	2185 lbs*	Firehawk Touring LS	16.35 @35 psi	16.52	NA	9.72
LT245/75R16	108 (LRC)	2205 lbs	Steeltex Radial A/T	11.6 @ 55 psi	15.13	13.08	7.51

* 1.1 load deration for application to light truck

RRC is a better rank order predictor for consumers



Note: All data is per the SAE J1269 procedure at 35 psi unless noted

RRC at 70% Load is a good rank order predictor for RRF at a given vehicle load over a large range of Load Indexes

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RRC Versus RRF Summary:

Vehicle:	Tire Size:	Load Index:	Max Load: (lbs)	RRF Based Proposal: SAE J1269 RRF (lbs) @ 70% Load:	Applying tires to same vehicle: RRF (lbs) @ vehicle load, 35 psi:	Applying tires to same vehicle: RRF (lbs) @ vehicle load, 50 psi:	RMA Proposal: SAE J1269 RRC (kg/tonne):
Corolla	P185/65R15	86	1168	7.43	9.14		9.09
	P195/65R15	89	1279	7.97	8.88		8.90
Malibu	P205/65R15	92	1400	10.83	12.29		11.05
	P215/60R16	94	1477	11.10	11.80		10.74
Suburban	P245/75R16	109	2065 *	15.98	17.08	NA	10.05
	P265/70R16	111	2185 *	16.35	16.52	NA	9.72
	LT245/75R16	108 (LR 'C')	2205	11.6 @ 55 psi	15.13	13.08	7.51

Using the SAE J1269 RRF at 70% Load can miss-lead consumers regarding the best choice for their vehicle

SAE J1269 RRC at 70% Load is a good rank order predictor for RRF at a given vehicle load over a large range of Load Indexes

RRC is a better rank order predictor than RRF for fuel efficiency for consumers

RRC Versus RRF Summary:

The RMA recommends using Rolling Resistance Coefficient (RRC) as the basis for a fuel efficiency rating system:

- RRC is more accurate than RRF in providing the consumer with fuel efficiency information and direction of choice for their vehicle
- It offers all consumers a choice among products appropriate for their vehicle.
- It leads consumers to select a tire choice that is appropriate for their vehicle from a fuel efficiency standpoint.
- It provides information about potential fuel efficiency.
- The recommended ISO 28580 test procedure for fuel efficiency grading is based upon RRC:
  - Lab Alignment is based upon RRC
  - Data quality requirements are based upon RRC

Developing a Rating System

- NHTSA “Stars on Cars” Program (www.safercar.gov)
- Rates aspects of vehicles in 5-star rating system
- Current applications
  - Crash test
  - Rollover ratings
  - Also used for new car seat rating regulation
- Consumers are starting to see 5-star approach to vehicle-related consumer information
- RMA believes that developing a 5-star tire efficiency rating systems would benefit consumers by providing information consistent with other consumer information

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Proposed 5-Star RRC Rating System

number of stars	minimum RRC	maximum RRC
5	NA	7.5
4	>7.5	9.0
3	>9.0	10.5
2	>10.5	12.0
1	>12.0	NA

Notes:(1)units are kg/tonne

(2) RRC values and ranges based on SAE J1269 single point test data.

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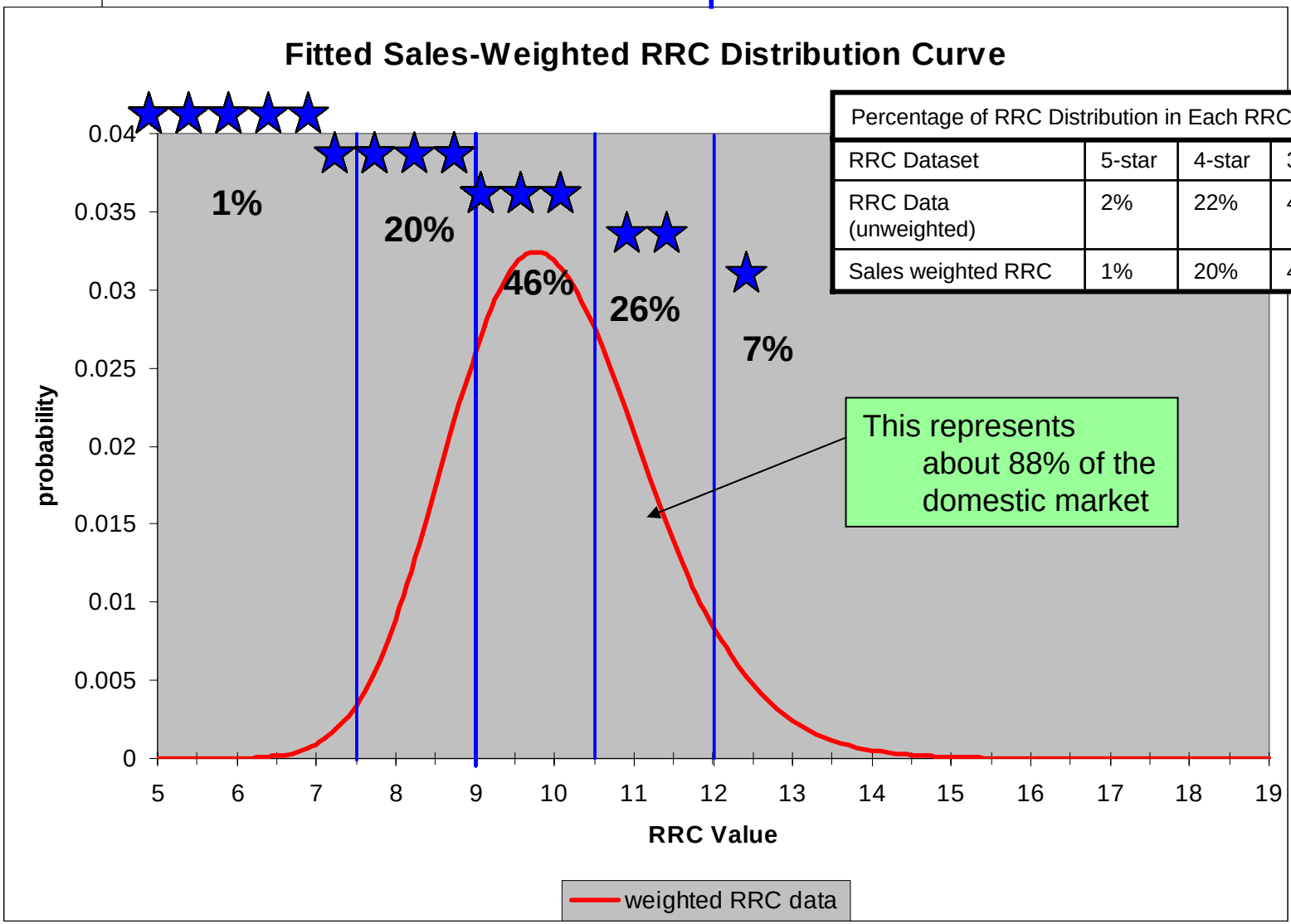
Fitted sales weighted RRC data using the SAE J1269 test procedure:



Percentage of RRC Distribution in Each RRC Rating Category					
RRC Dataset	5-star	4-star	3-star	2-star	1-star
RRC Data (unweighted)	2%	22%	44%	25%	7%
Sales weighted RRC	1%	20%	46%	26%	7%

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Consumer Choice Under Proposed RRC Rating System

- The RRC data set represents 200+ combinations of tire size (defined by 3 dimensions) and speed rating group
- These 200+ combinations account for almost 88% of the domestic replacement tire market
- Most of these combinations are represented by 2 or more RRC tests; these combinations account for nearly 80% of the domestic replacement tire market
- Most of the combinations represented by 2 or more RRC tests have more than one star rating, which is indicative of consumer choice under the proposed system
- The combinations for which consumer choice is demonstrated account for more than 75% of the domestic replacement tire market

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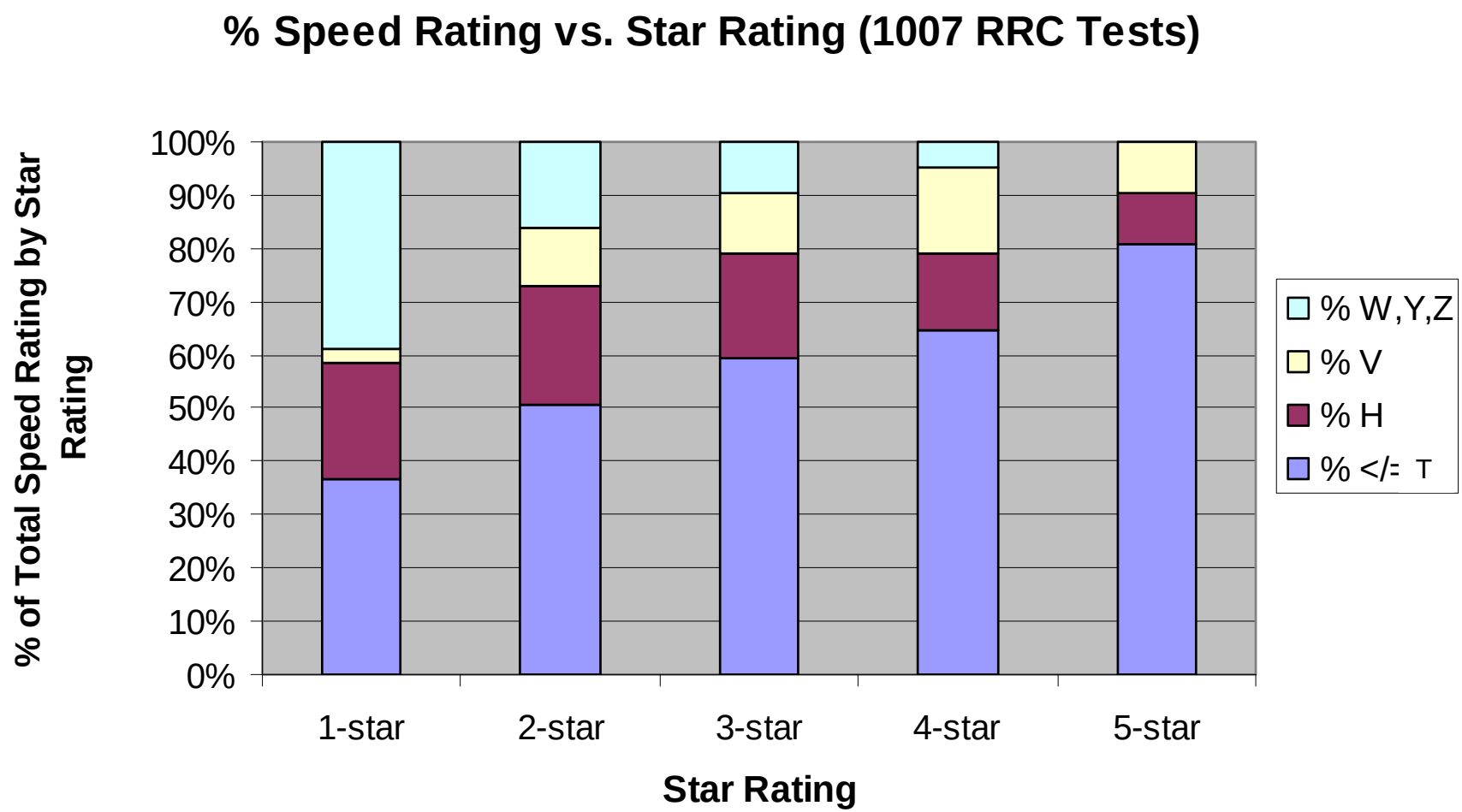

Consumer choices based upon RMA Star-rating proposal and tire speed rating (Capability)

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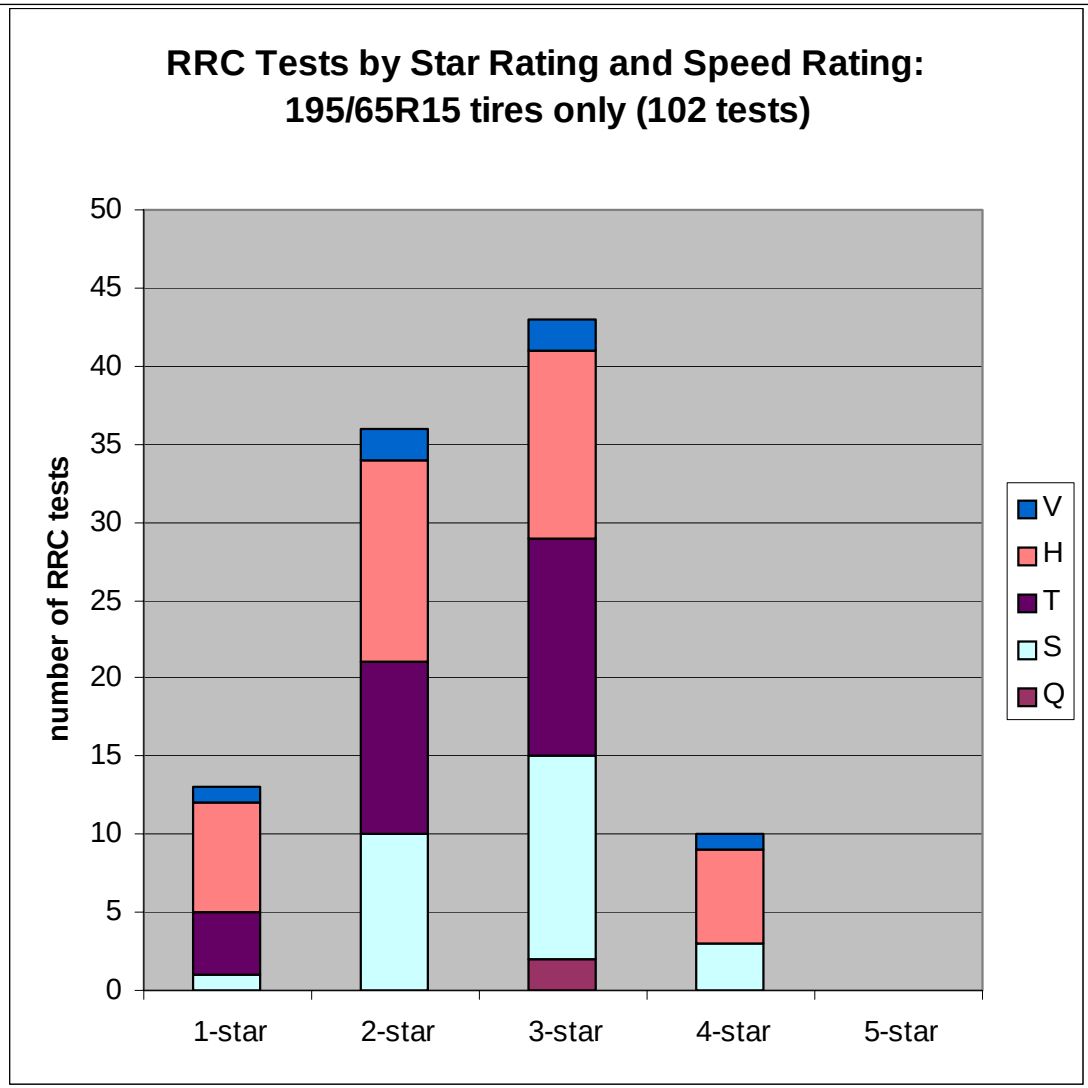

Consumer choices based upon RMA Star-rating proposal and tire speed rating for a 195/65R15 tire size.

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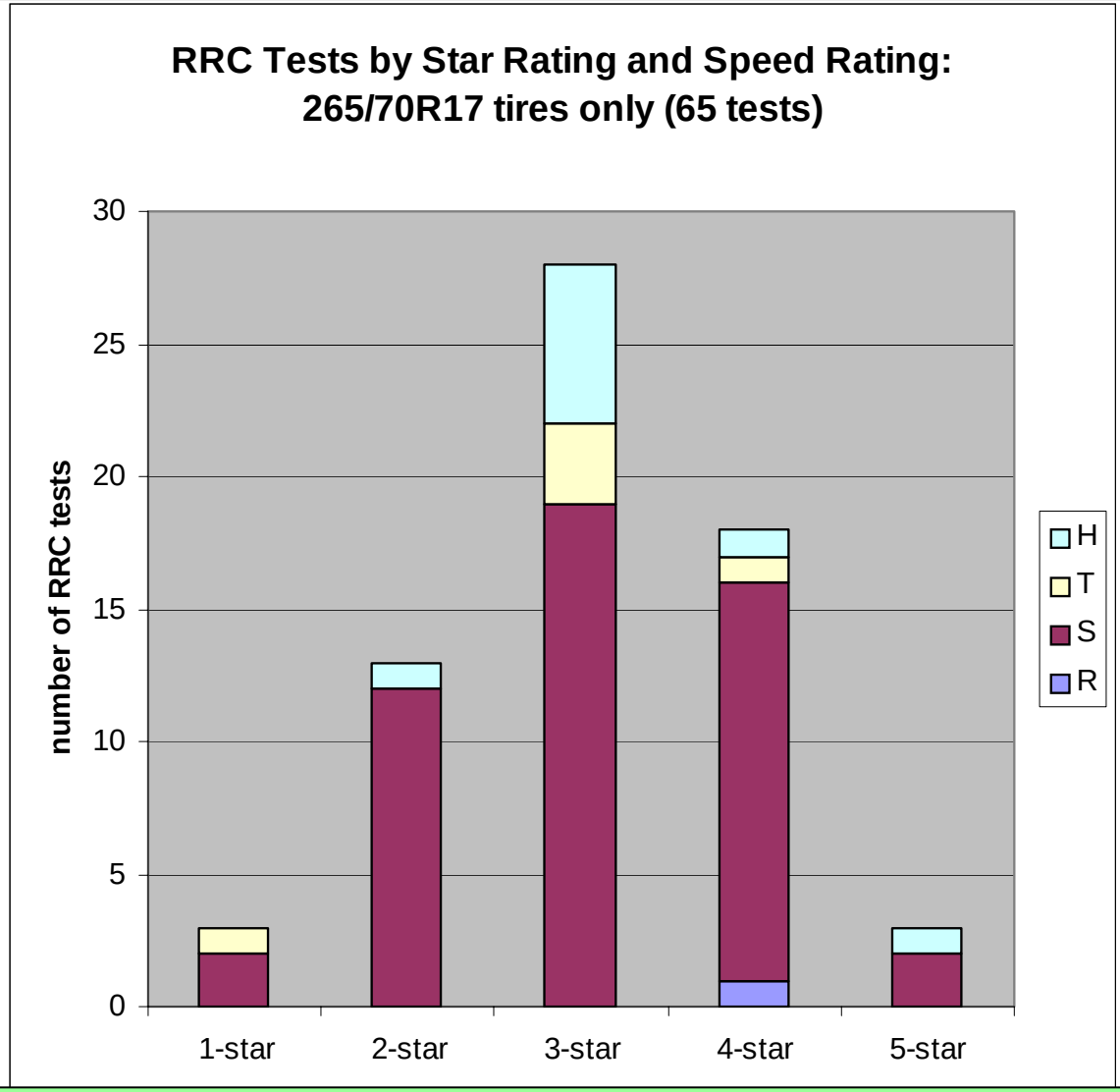

Consumer choices based upon RMA Star-rating proposal and tire speed rating for a 265/70R17 tire size.

How to provide additional information related to Safety and Durability so that the consumer will understand the related potential tire performance trade-offs?

Consumer Information Components

- Tire efficiency (rolling resistance)
- Safety (wet traction)
- Durability (treadwear)

The RMA proposes combining UTQG and fuel efficiency information for consumers

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Trend Analysis: RMA Star-rating proposal and UTQG Ratings

High Performance tires (High Speed Capability) typically have higher Traction ratings, but, lower average fuel efficiency and treadwear ratings versus baseline tires.

PreliminaryTrend Analysis: Fuel Efficiency Ratings vs. UTQG Ratings:

Speed Rating:	# Of Tires:	Star Rating:	UTQG Treadwear Range:	UTQG Traction:	UTQG Temp:
W - Z	0	5			
	7	4	220-300	AA (4) A (1)	A (5)
	46	3	80-440	AA (33) A (8)	A (41)
	41	2	140-400	AA (35) A (4)	A (39)
	29	1	200-400	AA (29)	A (29)
V	0	5			
	30	4	260 -440	A (28)	A (28)
	48	3	140 - 440	AA (2) A (31) B (1)	A (34)
	31	2	220 - 500	AA (6) A (12)	A (18)
	1	1	340	A (1)	A (1)
H	2	5	600	A (2)	A (2)
	30	4	180 -600	A (19) **B (2)**	A (19) B (2)
	95	3	200 - 600	AA (1) A (78)	A (78) B (1)
	53	2	260 - 740	AA (8) A (34)	A (41) B (1)
	16	1	300 - 560	AA (2) A (8)	A (10)
≤ T	17	5	240 - 700	A (12) B (5)	B (17)
	146	4	260 - 740	A (106) **B (12)**	A (20) B (96) C (1)
	307	3	180 - 800	A (251) B (13)	A (12) B (249) C (3)
	127	2	160 - 800	AA (1) A (116) B (2)	A (2) B (117)
	32	1	360 - 740	A (29)	A (2) B (27)
Trends: **As Speed Capability Increases**		**Average Fuel Efficiency And Choices Decrease**	**Average Treadwear Ratings Decrease**	**Average Traction Ratings Increase**	**Average Temperature Ratings Increase**

Integrating Safety and Durability Consumer Info.

- Use traction as surrogate for safety and treadwear as surrogate for durability
- Use UTQG and tire fuel efficiency rating together as consumer information at point of sale

RMA Concept:

Consolidated Rating for Tire Fuel Efficiency, Safety, and Durability:

XYZ Tire Company
Model – El Supremo
Size – P225/70R15

*** Uniform Quality Grading System Ratings**

RMA Concept:

How to Communicate Potential Fuel Savings to Consumers

		Estimated Annual Fuel Savings In Gallons					
				Vehicle Category			
		Hybrid	Compact	Midsize	Full Size	SUV	Pickup
Energy Upgrade	1>2 Star	6	8	10	12	14	16
	2>3 Star	6	8	10	12	14	16
	3>4 Star	6	8	10	12	14	16
	4>5 Star	6	8	10	12	14	16
	Assumption 15,000 miles per year mostly highway driving, passenger commuting						
	OE Vehilce placard size, inflation and speed rating, posted legal speed limits						

** Concept for illustration purposes only. **

Will Consumer Information Stimulate Manufacturer Competition and Innovation?

- Yes. The Federal UTQG program illustrates how the availability of consumer information stimulates competition and product improvement

RMA Proposed Rating System:

Summary:

- Rolling Resistance Coefficient RRC should be used as the rating system basis as opposed to RRF because:
  - Provides consumers with accurate fuel efficiency information and direction for their vehicle
  - ISO 28580 procedure is based upon RRC for lab alignment and data quality requirements
- The ISO 28580 procedure should be used as the test basis to rate tires for fuel efficiency (Includes provisions for lab alignment).
- A 5 star-rating system is recommended with 1.5 Kg/Tonne BIN widths as supported by the ISO 28580 Task Group lab alignment uncertainty values based upon measurement resolution of the best worldwide labs.
- Recommend using UTQG and tire fuel efficiency rating together as consumer information at point of sale
- A star-rating system could be linked to information providing consumers with average expected fuel savings/year.

Thank You

Questions ???