RUBBER manufacturers association

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March 3, 2009

Submitted electronically to docket@energy.state.ca.us
California Energy Commission
Dockets Office, MS-4
Re: Docket No. 07-FET-1
1516 Ninth Street
Sacramento, CA 95814-5512

RE: Comments on CEC Staff Workshop held February 5, 2009: Implementation of AB 844

On behalf of the tire manufacturer members of the Rubber Manufacturers Association, [1] I appreciate the opportunity to submit comments on the CEC staff workshop on AB 844 that was held on February **5**, 2009.

I. Rolling Force vs. Rolling Resistance Coefficient as the Basis for Consumer Information and Ratings

Significant discussion during the workshop centered around whether rolling force (RRf) or rolling resistance coefficient is a better metric to represent tire rolling resistance for use in consumer information. As stated in the workshop, RMA members support the use of rolling resistance coefficient (RRc) for the purpose of developing consumer information. In order to fully evaluate which metric is more appropriate, however, it is appropriate first to review the language of AB 844.

[1] The Rubber Manufacturers Association (RMA) is the national trade association representing more than 100 companies that manufacture various rubber products. These member companies include every major domestic tire manufacturer including: Bridgestone Americas Holding, Inc., Continental Tire N.A.; Cooper Tire & Rubber Company; The Goodyear Tire and Rubber Company; Michelin North America, Inc.; Pirelli North America; Toyo Tire (U.S.A.) Corporation; and Yokohama Tire Corporation.

AB 844 provides, in relevant part, that the mandated "rating system for the energy efficiency of replacement tire sold in the state [ ] will enable consumers to make more informed decisions when purchasing tires for their vehicles." Sec. 25571 (b). This language is instructive in a couple of ways. First, it specifies that the rating system is designed to provide information to consumers about replacement tires. Second, it provides that the rating system is designed to influence the purchase of tires for *their* vehicles, meaning that the consumer already owns the vehicle for which the replacement tires are being purchased.

Additionally, it is instructive to review the definition of *energy efficiency*. As we know, *efficiency* is defined as "effective operation as measured by a comparison of production with cost (as in energy, time, and money)" or "the ratio of the useful energy delivered by a dynamic system to the energy supplied to it." [2] *Energy efficiency*, then is a measure of production as a function of a common unit of measure. In the case of the energy efficiency of appliances, for example, *efficiency* is expressed as kilowatts per hour (unit of time).

Next, it is important to review the definitions of both RRc and RRf and how these metrics are obtained from rolling resistance testing. Rolling resistance, as measured by any of a number of test methods, is provided in rolling force, RRf, at the tested load for the tire measured. The tested load is a percentage of a maximum load carrying capacity of the tire. RRc, or rolling resistance coefficient is a unitless measurement calculated by dividing the measured RRf by the test load.[3] It is important to distinguish the RRf measured pursuant to a rolling resistance test method from the RRf that a tire would have on any given vehicle. The RRf of a tire on a particular vehicle is the rolling resistance

[2] Merriam-Webster Online, Definition of *Efficiency;* http://www.merriam-webster.com/dictionary/efficiency viewed March 3, 2009).

[3] It should be noted that while RRc is a unitless measurement in its pure form, it is often referenced in terms of kilograms per tonne. This metric is equivalent to the unitless measurement, except that the practical implication is to move the decimal three places to the right in the conversion, e.g., an RRc of 0.0085 is equivalent to 8.5 kilograms per tonne (the unitless RRc is multiplied by 1 kilogram/1 tonne).

coefficient, RRc, multiplied by the total mass, or weight of the vehicle (divided by four, since a consumer vehicle's load is carried by four tires).

The next step is to translate RRf and RRc into efficiency terms. Rolling resistance force is not an efficiency measurement, so it is not an appropriate basis for tire efficiency information. Rolling resistance coefficient, as stated above is a dimensionless measurement that can be expressed in terms of rolling force generated per unit load applied. This is an appropriate expression of efficiency and suitable as the basis for a consumer tire energy efficiency rating system.

On any given vehicle, the load would be essentially constant, whereas in a testing environment, load varies by the load carrying capacity of a tire. As applied to a potential tire rating system under AB 844, the load of a consumer's vehicle would be a constant, since the rating system applies to replacement tires on a vehicle currently owned by the consumer. If a rating system were provided in terms of RRf as measured, the consumer would be unable to compare rolling resistance of various tire sizes and load indices as applied to his or her vehicle, since the consumer's vehicle weight would not change appreciably based on tire choice. Instead, using RRf as measured a consumer would be able to make valid comparison only within a given tire size/load index.

In order to illustrate these points, Figures 1 through 4 were prepared by Bridgestone Americas Holding, Inc. Figures 1 through 3 graphically show RRc versus RRf. In both cases, the graphs illustrate that measured RRf is highly sensitive to load, while RRc is not. This makes sense, since as discussed above, RRf is RRc multiplied by the tested load.

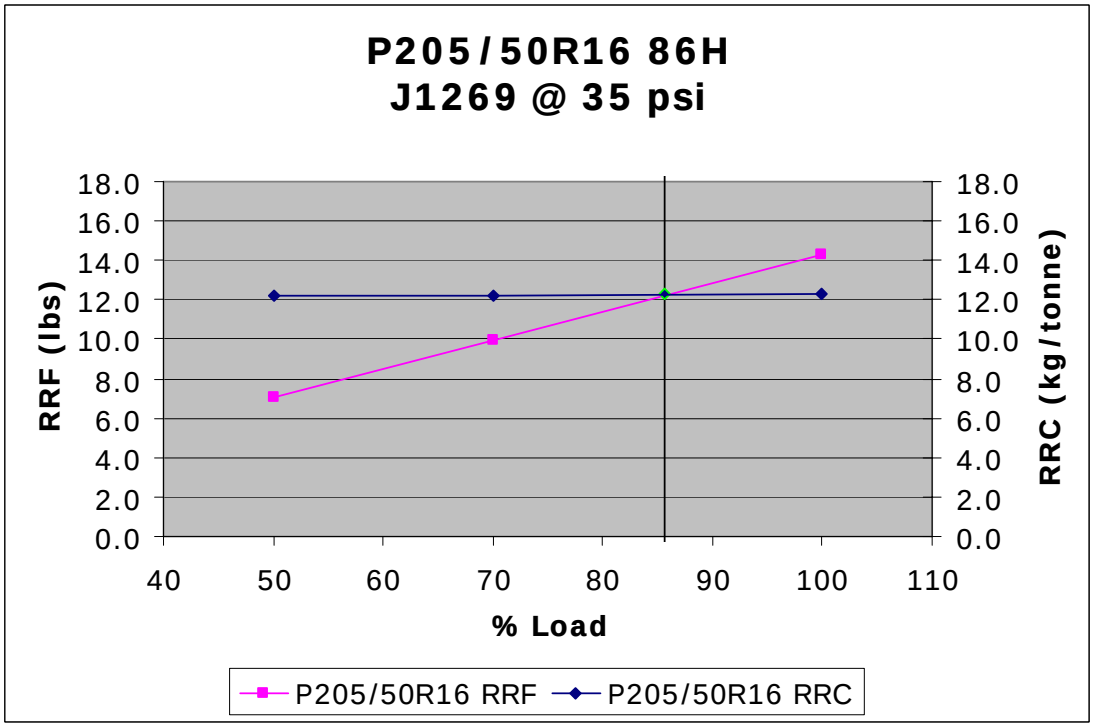

Figure 1. Illustration of RRf (lbs) and RRc (kg/tonne) as a Function of Load (P205/50R16 85H)

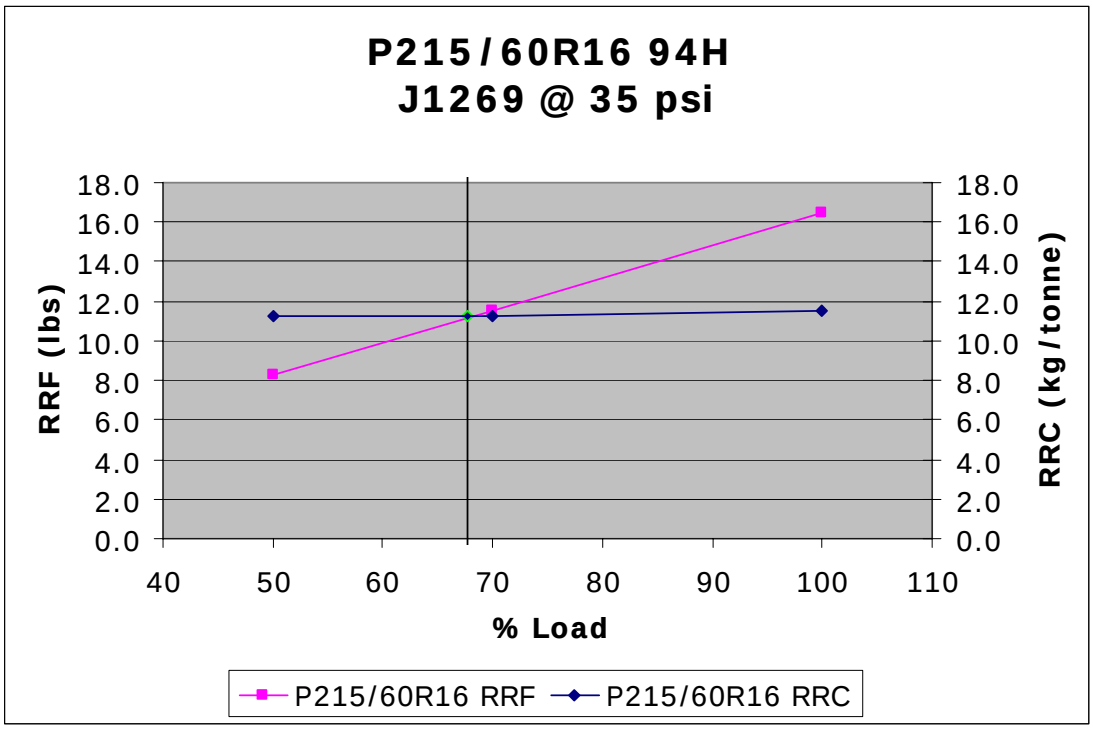

Figure 2. Illustration of RRf (lbs) and RRc(kg/tonne) as a Function of Load (P215/60R16 94 H)

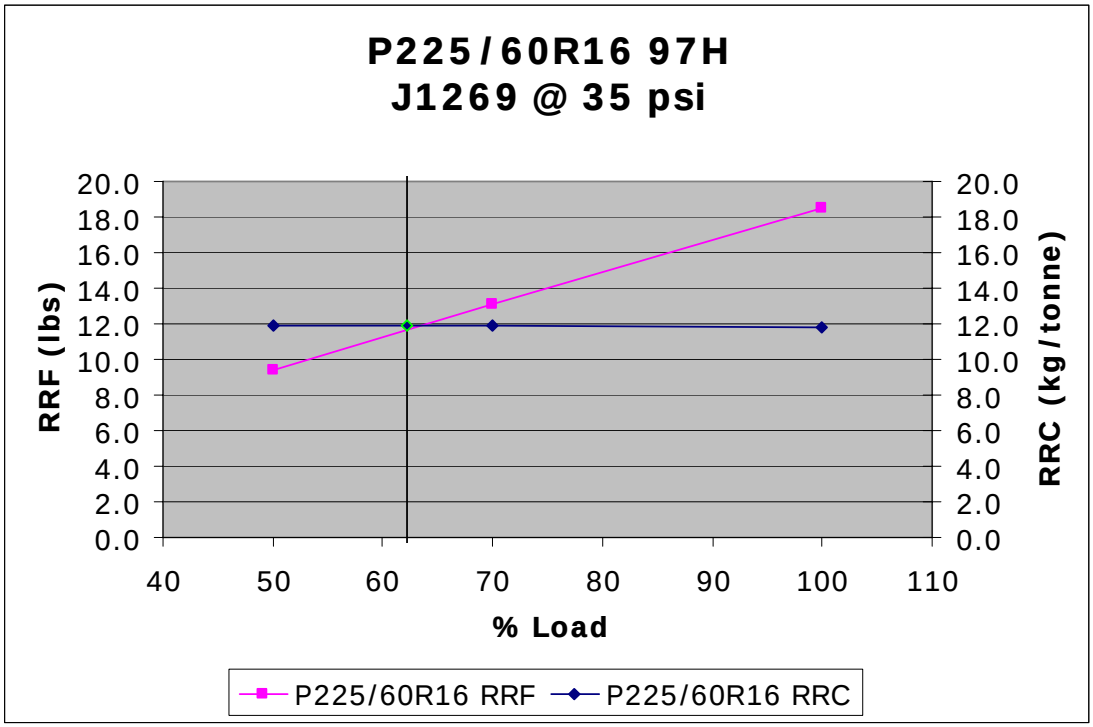

Figure 3. Illustration of RRf (lbs) and RRc(kg/tonne) as a Function of Load (P225/60R16 97H)

Figure 4 shows in the replacement tire scenario addressed by AB 844, RRc is a better source of consumer information for consumers replacing tires on a single vehicle. The analysis shows that when three tires of different sizes are ranked for rolling resistance using various options, there is a reversal in the rank order depending on whether measured RRf or RRc is used as the metric. Again, remember that measured RRf for different sized tire**s** are based on different loads, depending on the maximum load of the tire, while the consumer's vehicle represents a constant load. Calculating actual RRf, however, based on a constant load to reflect the constant load of a consumer's vehicle in need of replacement tires, the rank order of the three tires is consistent with the rank order produced by using RRc as the rolling resistance metric.

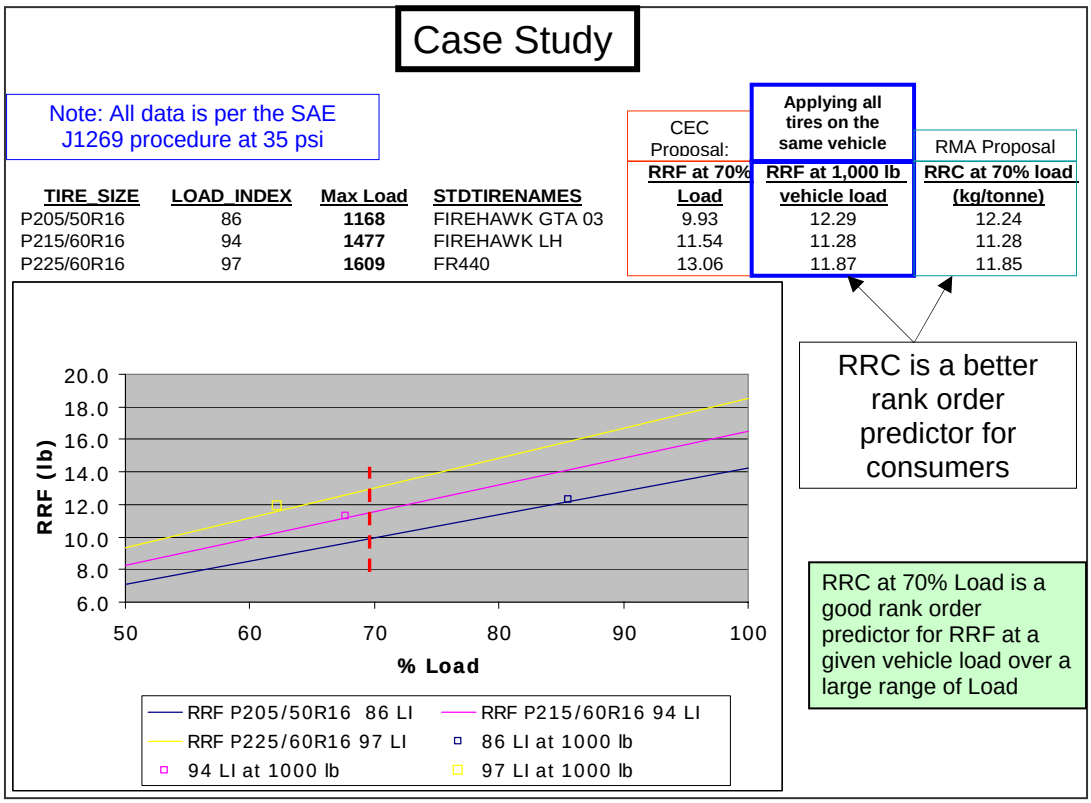

Figure 4. Case Study Showing that RRc is a Better Rank Order Predictor for Consumer Choice

Since the consumer's vehicle represents a constant, using that constant to calculate various RRf values for tire options is equivalent to comparing RRc for the tire options. Providing consumer information based on measured RRf would mislead the consumer about the relative rolling resistance of tire options available for his/her existing vehicle.

At the workshop, there was also some discussion about what message RRc based information would send to a Prius owner who sees that a tire for a larger vehicle is more fuel efficient than a tire suitable for the Prius. Aside from the obvious problems associated with actually installing an SUV tire on a Prius (e.g., the larger tire would not fit in the Prius wheel well), it is important to understand that for any given vehicle, the SUV tire on average would provide lower rolling resistance. The variable illustrated by comparing measured RRf values for Prius tires and larger tires is the difference in mass of the vehicles on which those tires are typically installed. Likewise, if both tires were installed on the same type of larger vehicle, the larger tire would be more efficient,

because the vehicle mass would be a constant, again ignoring the obvious size and safety implications of installing an undersized tire on a larger vehicle for purposes of this discussion.

While influencing vehicle choice may be viewed as a laudable environmental goal, it is beyond the purview of AB 844, which is focused on replacement tires for existing vehicles. Given that mandate, it is necessary to provide consumer information in a rating system pursuant to AB 844 that provides the consumer with comparisons appropriate to his/her vehicle.

II. Testing Variability and Rolling Resistance Information

At the workshop, there was significant discussion about variability in testing, both as a result of product variation and as a result of using different testing equipment. It is necessary to evaluate the variability from each of these sources separately and also to view them additively, because the variability from each of these sources is important and these two sources combine to account for the total uncertainty encountered in rolling resistance testing.

First, variability from product to product in the same tire SKU occurs for several reasons: variability within a manufacturing plant due to QA/QC tolerances, small manufacturing changes due to materials availability over time or in different geographic regions, manufacturing equipment or process changes, different manufacturing equipment available in different manufacturing plants, etc. This type of variability is necessary for manufacturing flexibility and efficiency. Product to product variability typically is small and does not relate to overall product quality or performance. However, as demonstrated by the data set compiled by Smithers in the initial testing for CEC, small differences in RRc may be detected in rolling resistance testing of multiple replicates of a specific tire SKU.

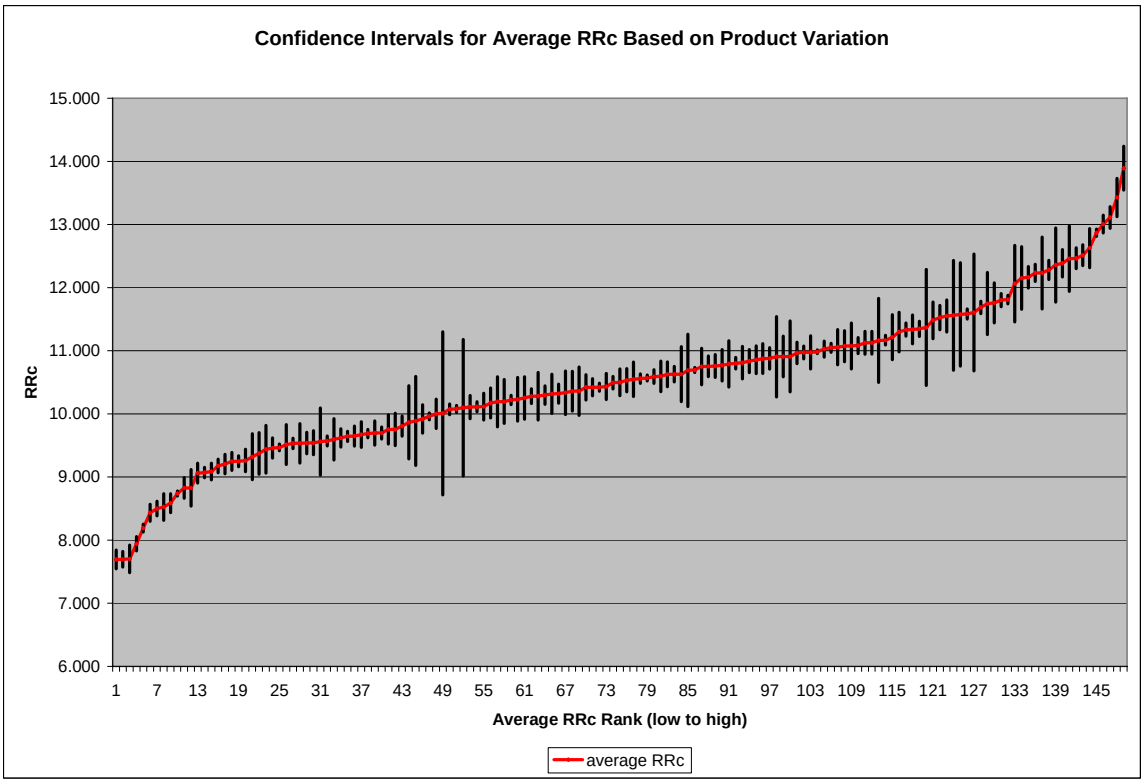

Figure 5. Confidence Intervals for Average RRc (kg/tonne) Based on Product Variation with 5 Replicates

Figure 5 shows the size of the 95 percent confidence interval for the average RRC value computed from the Smithers data set for each of the 149 tire SKUs tested for CEC. The data used to generate Figure 5 are provided at Appendix 1 at the end of this submission. The confidence interval is a range of values that is often written as the average value plus or minus a specified amount, for example 10.5 ± 0.5. For each of the tested SKUs, the probability that the true average RRc for the SKU is within the confidence interval is 95 percent. The average half-width in the table is ± 0.26, but the smallest confidence interval would be written as 10.98 ± 0.03 and the largest would be 10.01 ± 1.3. Thus, the uncertainty involved in estimating the average RRC for a tire SKU from a small number of tests varies substantially from one SKU to another and can be quite large for some tires. Reducing the number of replicate tests from 5 to 3 would likely double the half-width of these confidence intervals.

This analysis of product-to-product variability illustrates why rolling resistance values should be viewed as bands (intervals), taking into account uncertainty, rather than as single data points. Yet, product to product variability constitutes only part of the uncertainty equation. Variability from test machine to test machine provides additional uncertainty.

As discussed at the workshop, the ISO 28580 draft international standard provides a laboratory alignment method to limit the variability across test machines. However, it is important to distinguish limiting variability and resulting test uncertainty from eliminating variability. The laboratory alignment method provides the state of the art in terms of what is possible globally to reduce machine variability. For example, the draft ISO laboratory alignment method prerequisite for any one test machine is that pure machine variability be equal to or less than 0.075 Newtons per kiloNewton (equivalent to kilograms per tonne) for passenger and light truck tires.

Due to the additive effects of the uncertainty from these two sources, rolling resistance is best expressed by a tolerance band, rather than a data point, both for purposes of manufacturer reporting and consumer information. Tolerance bands are akin to rating categories, or groupings. Product to product variation and machine variation together dictate the minimum rating category size, based on the uncertainty surrounding individual measurements. Category groupings of 1.5 kilogram per tonne in width approach the minimum allowable width distinguishable with current technology. Requiring actual measurements to be reported does not take into account the uncertainty associated with such measurements and resulting ratings may serve to mislead consumers inappropriately ranking tires.

III. Testing Capacity and Industry Burden Analyses

During the workshop, Smithers Scientific made a presentation describing the tire marketplace and estimating current testing capacity and utilization in the tire industry. First, Smithers provided an evaluation of the number of unique tire SKUs in the U.S.

consumer tire market. RMA members have reviewed Smithers' calculations. RMA members agree that Smithers' SKU estimates accurately represent the U.S. tire market.

Next, Smithers provided a series of calculations to assess the available tire rolling resistance testing capacity within the industry globally. It is important to understand that current rolling resistance testing capacity serves the original equipment businesses of individual tire companies. Rolling resistance testing of tires for original equipment tire programs consumes most of the available testing capacity globally. Until recently, rolling resistance testing of replacement tires was not contemplated in most cases, because the focus of the replacement market has been on other product traits, including tread wear, traction and price. Overall, RMA members believe that the current calculations underestimate industry costs and overestimate existing available capacity. Further, RMA recommends that Smithers include additional items in its cost calculations to estimate the cost of new equipment.

On the issue of test capacity, Smithers evaluated available test capacity in the aggregate, across the industry globally. RMA has some concerns with this approach. Test capacity should be viewed on an individual company basis. It is unrealistic to assume that excess capacity in one company could be utilized by another company. Tire companies are unlikely to contract with a competitor to conduct rolling resistance compliance or development testing. Additionally, it is important to assess testing capacity on a regional basis. Tire manufacturers would test a tire in the region where that tire is manufactured. It is unrealistic to assume that a tire manufacturer would ship a candidate to another geographic region for rolling resistance testing. Test capacity available in a region other than where a tire is made should be viewed as unavailable for purposes of testing that tire.

RMA has surveyed its members to assess available testing capacity. Based on that survey, RMA believes that Smithers' assumptions of 25 and 50 percent available capacity vastly overstate unused rolling resistance testing capacity currently available. The RMA

survey shows that within the RMA membership, approximately 610 hours of unused rolling resistance testing capacity currently exist with current equipment and staffing, which represents under three percent of total current testing capacity. Approximately 21,000 additional testing hours could be achieved with an annual investment of about $1,125,000 to staff test laboratories for additional hours using existing equipment. The costs represent staffing costs only, not electricity and other related costs incurred by increased machine operation. This additional testing capacity represents about 2,625 rolling resistance tests following the ISO 28580 Draft International Standard, assuming approximately eight hours per test. Assuming three replicates per SKU, consistent with the Smithers assumptions, 875 SKUs could be tested per year at the annual aggregate labor cost of $1,125,000, plus the additional energy and other operating costs associated with machine operation, additional HVAC usage and data analyses.

After reviewing Smithers' assumptions and calculations for new equipment purchase, RMA offers the following comments. RMA agrees that Smithers' estimated equipment cost is in the right range. However, RMA believes that Smithers' needs to add an estimated cost for land, floor space and building costs. It should not be assumed that tire manufacturers have additional unused floor space in existing facilities to accommodate additional test equipment. RMA recommends that building and floor space costs be estimated to be between 30 and 60 percent of equipment costs depending on whether constructing a new building is required, in terms of capital expenses. Additional cost estimates should also be provided for operating expenses associated with floor space. Depending on the geographic location of a particular tire company's operations, floor space costs may be significant. As mentioned above, calculations for additional testing time, either with existing equipment or with newly-acquired equipment should also include necessary energy costs associated with the test equipment and HVAC usage.

Last, but importantly, the Smithers cost estimates contemplate the level of resources needed conduct initial testing on existing products sold in the state of California. In the tire industry, new products and sizes are constantly being introduced and old products

discontinued. Reporting requirements would affect new products developed each year, in addition to those products already offered for sale in the state. Furthermore, tire companies would also conduct ongoing compliance and manufacturing surveillance testing to assure compliance with requirements. This additional testing volume should be included in the testing burden estimate.

IV. Evaluating Costs and Benefits

Even as presented at the workshop, the costs and time associated with complying with a potential requirement to test every SKU in triplicate are significant. In evaluating these costs, CEC must also weigh them against the benefits achieved by the requirement as compared with the costs and benefits of other alternatives. RMA respectfully requests that this cost-benefit analysis consider the lower costs and comparable benefits associated with a tire manufacturer self-certification requirement to report energy efficiency ratings.

RMA would appreciate an opportunity to present to all stakeholders in a public forum its concept for a rating system and reporting requirements based on self-certification. RMA supports this approach as a more cost effective option for providing consumer information to purchasers of replacement tires for their vehicles without negatively affecting the benefit to consumers or the environment. Recalling the requirements of AB844, tire manufacturer reporting requirements should be based on the selected test method and the rating system developed under the program.

Furthermore, RMA recommends that costs to the tire industry associated with any regulatory options should be viewed in light of the significant economic challenges faced by the tire industry in this time of economic recession. At the end of 2008, RMA reported that the U.S. tire industry total shipments were under 300 million units for the first time since 1997. In the first months of 2009, the tire industry has continued to see a sharp decline in demand for new tires. Recent RMA market analyses project that U.S. tire industry shipments will not return to 2007 levels until 2014. On the original

equipment side, the tire industry has been affected by the severe decline in new vehicle sales. Media reports indicate that January 2009 U.S. auto sales were down 37 percent from one year ago, the lowest level since 1981.[4] The replacement tire market is also seeing contraction, although not at the rate seen in the original equipment market. Replacement tire purchases are being delayed, as are other major consumer purchases, as a reflection of the lack of consumer confidence in the U.S. economy. The Conference Board Consumer Confidence Index™ declined moderately in January 2009 and again in February 2009. The index was at 50 (1985=100) in June of 2008, up to just under 65 in September 2008 and then dropped precipitously to 25.0 in February, its lowest level since its inception in 1967.[5] The tire industry continues to announce production cuts, layoffs and other measures to adjust for the downturn in the economy.

Of course, the tire industry values the overall contribution of tires to consumer fuel economy. The tire industry supports the concept of providing ratings on the efficiency of replacement tires to consumers to assist them in their tire purchases. However, the tire industry requests that consideration be given to cost effective approaches that would achieve that goal.

V. Next Steps

RMA understands that CEC is planning a workshop to be held on April 8, 2009. RMA welcomes the opportunity to give presentations on several topics discussed in these topics to facilitate a dialogue among all stakeholders. At that workshop, RMA would like to present on the topics of rolling resistance force versus rolling resistance coefficient, rolling resistance data collection and market coverage, categorical rolling resistance rating proposal and consumer information, self certification as a proposed means of compliance and the relative industry costs and environmental benefits associated with

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[4] *Detroit Reels as Auto Sales Skid*, Wall Street Journal Online, February 19, 2009. http://online.wsj.com/article/SB123367018137943377.html (viewed March 3, 2009).

[5] Consumer Confidence 0Survey™ Press Release: The Conference Board Consumer Confidence Index™ Plummets Further in February, February 24, 2009. http://www.conference-board.org/economics/ConsumerConfidence.cfm (viewed March 3, 2009).

various rating systems and industry reporting approaches. RMA looks forward to working with CEC to develop a detailed agenda for the April 8, 2009 staff workshop.

Thank you for the opportunity to provide these comments. We look forward to a continuing public dialogue with other stakeholders in this process.

Respectfully submitted,

Tracey J. Norberg
Senior Vice President and Corporate Counsel

Appendix 1

CEC Tire Test Data Set – Compilation
149 tire size/line combinations from CEC data files

Group ID	Tire Size	Market	average RRC based on 5 replicates	standard deviation of RRC based on 5 replicates	half-width of 95% confidence interval based on 5 replicates
195-38	P195/65R15	REP	10.98	0.023	0.03
195-76	195/65R15	REP	10.70	0.032	0.04
195-15	195/65R15	OE	8.74	0.032	0.04
195-74	P195/65R15	REP	10.57	0.037	0.05
195-60	P195/65R15	OE	9.47	0.043	0.05
265-44	265/70R17	REP	9.96	0.045	0.06
195-58	P195/65R15	REP	10.08	0.045	0.06
SIS-24	P165/80R13	REP	12.87	0.045	0.06
195-65	195/65R15	OE	8.19	0.050	0.06
195-69	195/65R15	REP	10.42	0.052	0.06
195-05	P195/65R15	OE	9.69	0.053	0.07
195-66	P195/65R15	REP	11.81	0.054	0.07
195-33	P195/65R15	REP	11.05	0.057	0.07
265-25	P265/70R17	REP	10.22	0.060	0.07
265-12	P265/70R17	REP	11.17	0.061	0.08
195-11	P195/65R15	REP	10.56	0.061	0.08
265-07	P265/70R17	REP	9.57	0.063	0.08
265-40	P265/70R17	REP	9.64	0.064	0.08
195-18	P195/65R15	REP	11.58	0.065	0.08
SIS-16	P205/70R15	REP	10.11	0.065	0.08
195-02	P195/65R15	OE	9.07	0.067	0.08
195-30	P195/65R15	REP	9.53	0.067	0.08
265-30	P265/70R17	REP	9.25	0.069	0.09
195-71	P195/65R15	REP	10.07	0.069	0.09
195-46	195/65R15	REP	10.80	0.075	0.09
195-17	195/65R15	REP	9.70	0.076	0.09
195-47	195/65R15	REP	11.69	0.079	0.10
SIS-04	P175/80R13	REP	10.49	0.081	0.10
195-44	P195/65R15	REP	10.97	0.082	0.10
265-46	P265/70R17	REP	11.33	0.084	0.10
195-16	P195/65R15	REP	11.80	0.084	0.10
195-72	P195/65R15	REP	10.59	0.086	0.11
265-03	P265/70R17	OE	9.18	0.087	0.11
265-17	P265/70R17	OE	7.94	0.090	0.11
195-04	P195/65R15	OE	8.50	0.094	0.12
265-23	P265/70R17	REP	10.28	0.095	0.12

Appendix 1, continued

CEC Tire Test Data Set - Compilation
149 tire size/line combinations from CEC data files

Group ID	Tire Size	Market	average RRC based on 5 replicates	standard deviation of RRC based on 5 replicates	half-width of 95% confidence interval based on 5 replicates
SIS-21	P195/65R15	REP	11.35	0.096	0.12
265-26	P265/70R17	OE	7.70	0.100	0.12
SIS-08	P215/70R14	REP	10.63	0.100	0.12
195-13	P195/65R15	REP	11.08	0.101	0.13
195-48	P195/65R15	REP	11.03	0.102	0.13
265-09	P265/70R17	OE	9.09	0.106	0.13
195-09	P195/65R15	REP	12.23	0.108	0.13
265-01	P265/70R17	OE	8.43	0.110	0.14
195-27	195/65R15	REP	10.42	0.111	0.14
265-19	P265/70R17	REP	9.25	0.113	0.14
195-12	P195/65R15	REP	13.01	0.114	0.14
265-27	P265/70R17	OE	9.62	0.117	0.14
SIS-01	P215/60R16	REP	10.30	0.117	0.15
265-06	P265/70R17	OE	7.69	0.120	0.15
265-15	P265/70R17	OE	8.58	0.121	0.15
195-28	P195/65R15	REP	10.32	0.122	0.15
SIS-05	P175/70R14	REP	12.28	0.123	0.15
195-77	195/65R15	OE	9.21	0.125	0.15
265-10	P265/70R17	OE	9.06	0.127	0.16
265-20	P265/70R17	REP	9.65	0.128	0.16
265-08	P265/70R17	REP	9.46	0.129	0.16
195-62	P195/65R15	REP	9.81	0.129	0.16
195-53	P195/65R15	OE	8.83	0.131	0.16
265-36	P265/70R17	REP	10.75	0.132	0.16
195-63	195/65R15	REP	12.51	0.133	0.17
SIS-11	P155/80R13	REP	12.47	0.133	0.17
265-41	P265/70R17	REP	9.54	0.136	0.17
265-29	P265/70R17	REP	10.88	0.137	0.17
195-61	P195/65R15	OE	10.96	0.137	0.17
195-22	P195/65R15	REP	13.11	0.138	0.17
195-24	P195/65R15	REP	12.16	0.138	0.17
265-16	P265/70R17	REP	9.26	0.143	0.18
195-73	P195/65R15	REP	11.13	0.144	0.18
265-31	P265/70R17	REP	11.13	0.146	0.18
195-26	195/65R15	REP	10.84	0.146	0.18
SIS-09	P225/75R15	REP	10.76	0.147	0.18
195-50	195/65R15	REP	10.11	0.148	0.18

Appendix 1, continued (2)

CEC Tire Test Data Set - Compilation

149 tire size/line combinations from CEC data files

Group ID	Tire Size	Market	average RRC based on 5 replicates	standard deviation of RRC based on 5 replicates	half-width of 95% confidence interval based on 5 replicates
265-42	P265/70R17	REP	10.53	0.149	0.18
195-68	P195/65R15	REP	9.70	0.153	0.19
265-47	P265/70R17	REP	9.54	0.153	0.19
SIS-06	P185/80R13	REP	11.53	0.156	0.19
265-18	P265/70R17	REP	10.63	0.159	0.20
SIS-15	P195/75R14	REP	10.42	0.161	0.20
265-34	P265/70R17	REP	9.67	0.162	0.20
265-33	P265/70R17	REP	10.43	0.166	0.21
195-75	P195/65R15	REP	10.12	0.170	0.21
265-37	P265/70R17	REP	8.52	0.170	0.21
195-70	195/65R15	REP	10.50	0.170	0.21
265-14	P265/70R17	REP	12.39	0.174	0.22
265-11	P265/70R17	OE	7.70	0.175	0.22
265-05	P265/70R17	REP	10.86	0.176	0.22
195-54	P195/65R15	OE	9.92	0.181	0.22
195-49	P195/65R15	REP	11.34	0.185	0.23
265-43	265/70R17	REP	10.00	0.187	0.23
195-45	P195/65R15	REP	9.75	0.187	0.23
195-36	195/65R15	REP	10.88	0.190	0.24
SIS-23	P225/60R16	REP	10.17	0.191	0.24
195-55	P195/65R15	OE	10.60	0.195	0.24
SIS-28	P205/75R14	REP	11.07	0.198	0.25
265-32	P265/70R17	REP	10.77	0.200	0.25
195-59	195/65R15	REP	11.55	0.203	0.25
195-10	P195/65R15	REP	9.75	0.207	0.26
195-56	P195/65R15	REP	10.81	0.208	0.26
195-35	P195/65R15	REP	10.98	0.211	0.26
195-32	P195/65R15	REP	10.55	0.219	0.27
SIS-13	P185/75R14	REP	11.06	0.225	0.28
SIS-22	P205/65R15	REP	10.75	0.232	0.29
195-52	195/65R15	OE	8.83	0.233	0.29
SIS-18	P175/70R13	REP	11.48	0.233	0.29
195-08	P195/65R15	REP	13.43	0.244	0.30
265-22	P265/70R17	REP	12.63	0.249	0.31
195-67	195/65R15	REP	10.32	0.250	0.31
195-42	P195/65R15	REP	11.30	0.252	0.31
195-51	195/65R15	REP	9.53	0.252	0.31

Appendix, continued (3)

CEC Tire Test Data Set - Compilation

149 tire size/line combinations from CEC data files

Group ID	Tire Size	Market	average RRC based on 5 replicates	standard deviation of RRC based on 5 replicates	half-width of 95% confidence interval based on 5 replicates
195-23	P195/65R15	REP	10.36	0.253	0.31
195-34	P195/65R15	REP	9.51	0.254	0.32
195-39	P195/65R15	REP	11.76	0.255	0.32
195-64	P195/65R15	REP	10.91	0.260	0.32
195-41	195/65R15	REP	9.60	0.264	0.33
265-38	P265/70R17	REP	9.37	0.265	0.33
SIS-20	P235/75R15	REP	10.25	0.270	0.34
265-48	P265/70R17	REP	10.34	0.278	0.34
265-45	P265/70R17	REP	10.23	0.279	0.35
195-21	P195/65R15	REP	13.89	0.280	0.35
SIS-26	P205/75R15	REP	10.20	0.280	0.35
265-04	P265/70R17	REP	11.22	0.287	0.36
265-24	P265/70R17	REP	11.08	0.292	0.36
SIS-03	205/70R14	REP	10.79	0.293	0.36
195-03	P195/65R15	REP	9.32	0.293	0.36
SIS-07	P215/75R15	REP	10.28	0.304	0.38
195-14	P195/65R15	REP	9.44	0.305	0.38
195-31	P195/65R15	REP	10.36	0.308	0.38
SIS-02	P215/65R15	REP	10.19	0.320	0.40
265-13	P265/70R17	OE	10.63	0.349	0.43
SIS-14	195/70R14	REP	11.75	0.396	0.49
SIS-17	175/65R14	REP	12.15	0.399	0.50
SIS-19	185/70R13	REP	12.46	0.416	0.52
195-06	P195/65R15	REP	9.56	0.428	0.53
265-35	P265/70R17	REP	10.91	0.453	0.56
195-20	P195/65R15	REP	12.23	0.459	0.57
195-25	195/65R15	REP	10.69	0.461	0.57
SIS-27	P215/70R15	REP	9.87	0.466	0.58
195-01	P195/65R15	REP	12.36	0.472	0.59
SIS-10	185/65R14	REP	12.06	0.488	0.61
195-29	195/65R15	REP	10.91	0.512	0.64
195-57	P195/65R15	REP	11.16	0.535	0.66
195-07	P195/65R15	OE	9.89	0.568	0.71
SIS-12	185/70R14	REP	11.58	0.660	0.82
195-37	P195/65R15	REP	11.56	0.700	0.87
SIS-25	P215/75R14	REP	11.37	0.741	0.92
195-19	P195/65R15	REP	11.61	0.744	0.92
195-43	P195/65R15	REP	10.10	0.871	1.08
265-28	P265/70R17	OE	10.01	1.041	1.29