



# OFFICE MEMORANDUM

DATE: November 4, 1982

TO: R. L. Felter, Supervisor  
Pavement Performance Group

FROM: P. T. Luce

SUBJECT: ASTM E501 Test Tire Correlation, B. F. Goodrich vs. McCreary  
Research Project 54 G-74, Research Report No. R-1205

The production of ASTM pavement friction test tires (E501 and E524) changed recently from the B. F. Goodrich to McCreary Tire Co. While tire composition is controlled by ASTM specification, some performance differences between suppliers has been noted by others, as well as locally under the wear track application (E524) at the MDOT Research Laboratory.\* Subsequently, and as a matter of routine practice, a correlation study was completed September 28, 1982, comparing friction level measurements for E501 tires produced by both manufacturers.

Pavement friction measurements were conducted at 19 sites. Site selection was based on homogeneous appearance throughout the test length, degree of wear, type of surface material (concrete and bituminous), aggregate type (limestone and natural), and degree of surface texturing, in an effort to provide as wide a range of available friction as possible. These sites include old and new surfaces, milled and grooved textures, a flushed asphalt condition, and both outside and inside lanes of multilane roads.

No statistical approach to test sampling was implemented; however, initial speed and tire selection were randomized at each site in an effort to minimize bias. Friction measurements were performed in the inside (left) wheeltrack position utilizing the left test wheel of tester 67-0801 (Law). Five test speeds were chosen ranging from 10 to 50 mph at 10 mph increments. A minimum of three tests per site/tire/speed were performed at speeds of 30 mph and above. The number of tests at lower speeds were increased by a factor of three at 10 mph and two at 20 mph to equalize sample lengths due to the time/distance nature of test equipment. This provides a minimum sample of 24 individual tests per site/tire. A total of 926 friction measurements (463 per tire) were averaged to provide a sample of 95 pairs for correlation comparison (Table 1).

Results of linear regression analysis indicate excellent correlation between the two manufacturers' tires under all tested conditions (Fig. 1). Similar results are obtained

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\* Hill and Wambold, Pennsylvania Transportation Institute, December 1, 1980 (report to T. M. Knowles, Chairman, ASTM Subcommittee E17.24).

comparing site rankings by friction level (Table 2). A plot of speed versus average friction level (SN) for combined sites indicates some possible sensitivity between tires with respect to speed (Fig. 2). Below a test speed of 30 mph the McCreary tire measured slightly higher, and above 30 mph slightly lower friction levels than the Goodrich tire. The difference is small, less than 1 SN, and much lower than typical equipment standard deviation on the order of 1.5 or greater.

Based on these comparisons there is no need to apply correction factors to equate McCreary with Goodrich E501 tires.

TESTING AND RESEARCH DIVISION

*S. T. Luce*

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Engineering Technician

PTL:bt

TABLE 1  
 1982 E501 TEST TIRE COMPARISON  
 (G = Goodrich, M = McCreary)

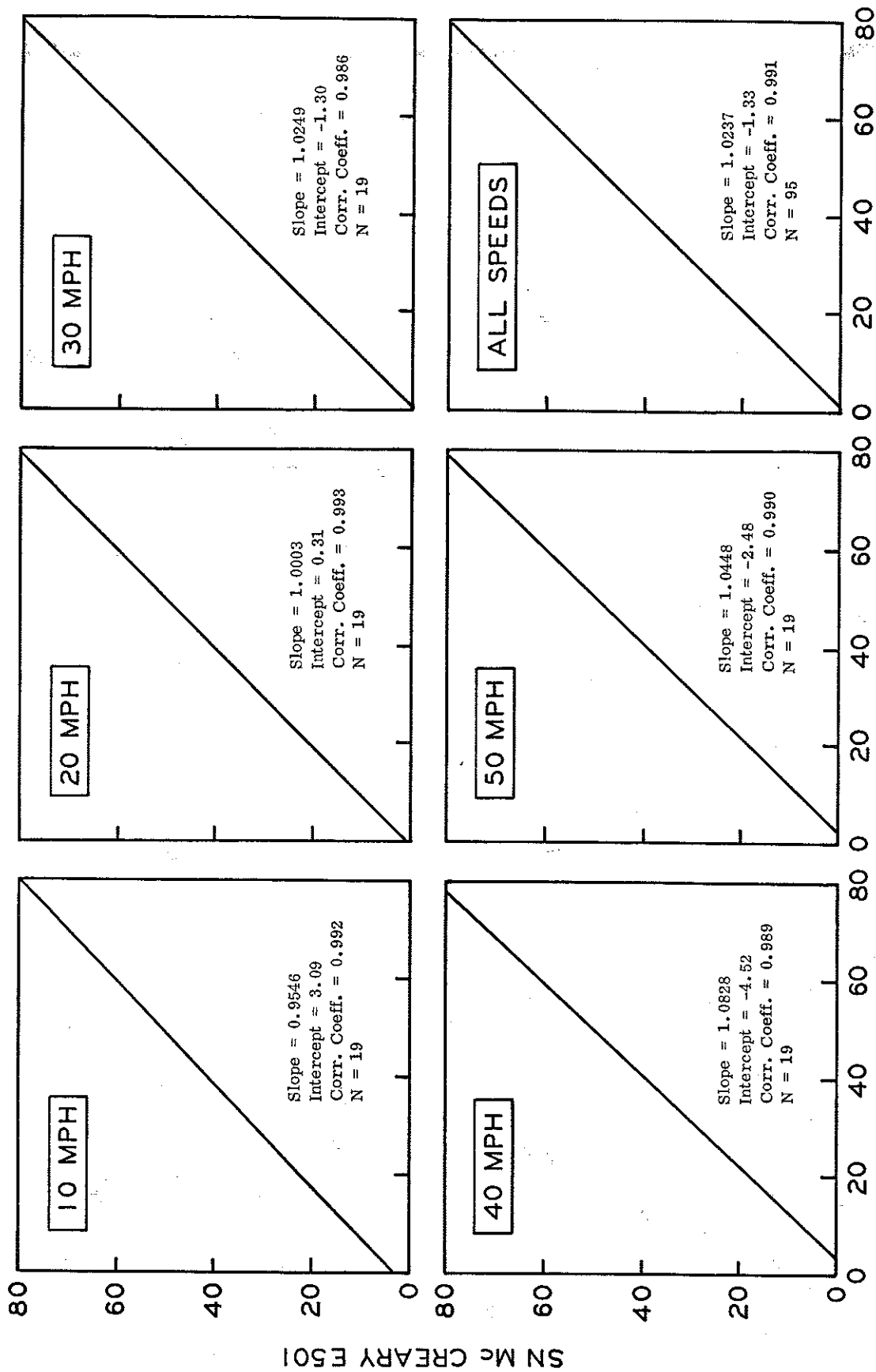
Test Site No.	Average SN									
	10 mph		20 mph		30 mph		40 mph		50 mph	
	G	M	G	M	G	M	G	M	G	M
1	63.7	60.9	60.8	60.0	55.0	54.7	50.7	49.3	46.0	43.3
2	77.0	73.7	67.8	67.7	62.3	63.3	58.3	59.7	56.0	56.0
3	46.1	48.4	43.0	45.2	38.3	40.3	35.7	34.0	31.0	31.7
4	54.9	56.3	50.5	52.2	47.7	47.7	43.3	42.0	40.0	40.0
5	76.7	75.1	72.7	70.0	67.3	64.7	61.3	56.7	55.0	53.0
6	59.9	59.4	55.0	55.3	49.7	49.7	44.7	46.0	42.3	43.7
7	77.3	74.8	73.0	71.2	68.0	64.3	60.3	59.7	56.0	53.7
8	52.6	52.1	47.8	47.7	43.3	41.3	41.7	37.3	35.3	33.7
9	63.1	64.4	57.3	59.2	53.7	53.7	48.0	48.0	44.3	44.7
10	79.4	79.9	75.8	75.5	69.7	69.7	62.3	62.7	57.3	56.7
11	48.4	51.6	46.0	47.8	40.0	42.3	37.7	37.7	36.3	34.0
12	66.6	67.0	62.0	61.2	54.3	56.0	49.3	50.7	47.0	45.7
13	52.7	53.0	47.5	48.3	43.3	39.7	38.3	37.0	34.3	34.7
14	63.9	66.7	60.2	62.0	54.3	57.3	52.0	53.7	48.0	50.3
15	65.2	67.2	62.2	63.8	57.3	60.7	55.3	55.3	49.0	52.0
16	38.1	39.2	35.7	35.0	32.3	31.0	30.7	29.7	29.7	26.7
17	40.0	41.2	36.2	36.8	32.7	34.3	31.3	30.0	30.3	28.0
18	88.6	90.1	79.5	82.8	71.7	74.0	66.0	69.7	64.7	66.0
19	43.1	42.5	33.7	31.2	27.7	23.3	25.0	20.7	21.0	19.3
Mean SN All Sites	60.9	61.2	56.1	56.5	51.0	51.0	46.9	46.3	43.3	42.8

TABLE 2  
 1982 E501 TEST TIRE COMPARISON  
 Site Ranking Low to High (by Friction Level at Indicated Speed)  
 (G = Goodrich, M = McCreary)

Test Site No.	Site Rank									
	10 mph		20 mph		30 mph		40 mph		50 mph	
	G	M	G	M	G	M	G	M	G	M
1	11	10	12	11	13	11	12	11	11	9
2	16	15	15	15	15	15	15	16	17	17
3	4	4	4	4	4	5	4	4	4	4
4	8	8	8	8	8	8	8	8	8	8
5	15	17	16	16	16	17	17	15	15	15
6	9	9	9	9	9	9	9	9	9	10
7	17	16	17	17	17	16	16	17	16	16
8	6	6	7	5	6	6	7	6	6	5
9	10	11	10	10	10	10	10	10	10	11
10	18	18	18	18	18	18	18	18	18	18
11	5	5	5	6	5	7	5	7	7	6
12	14	13	13	12	11	12	11	12	12	12
13	7	7	6	7	7	4	6	5	5	7
14	12	12	11	13	12	13	13	13	13	13
15	13	14	14	14	14	14	14	14	14	14
16	1	1	2	2	2	2	2	2	2	2
17	2	2	3	3	3	3	3	3	3	3
18	19	19	19	19	19	19	19	19	19	19
19	3	3	1	1	1	1	1	1	1	1
Rank (r) Correlation Coefficient	0.991		0.989		0.981		0.988		0.989	

$$r_{\text{rank}} = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$$

D = difference between rank of corresponding x and y  
 N = number of pairs (x, y)



SN GOODRICH E501

Figure 1. 1982 E501 Test Tire Correlation  
Linear Regression Summary

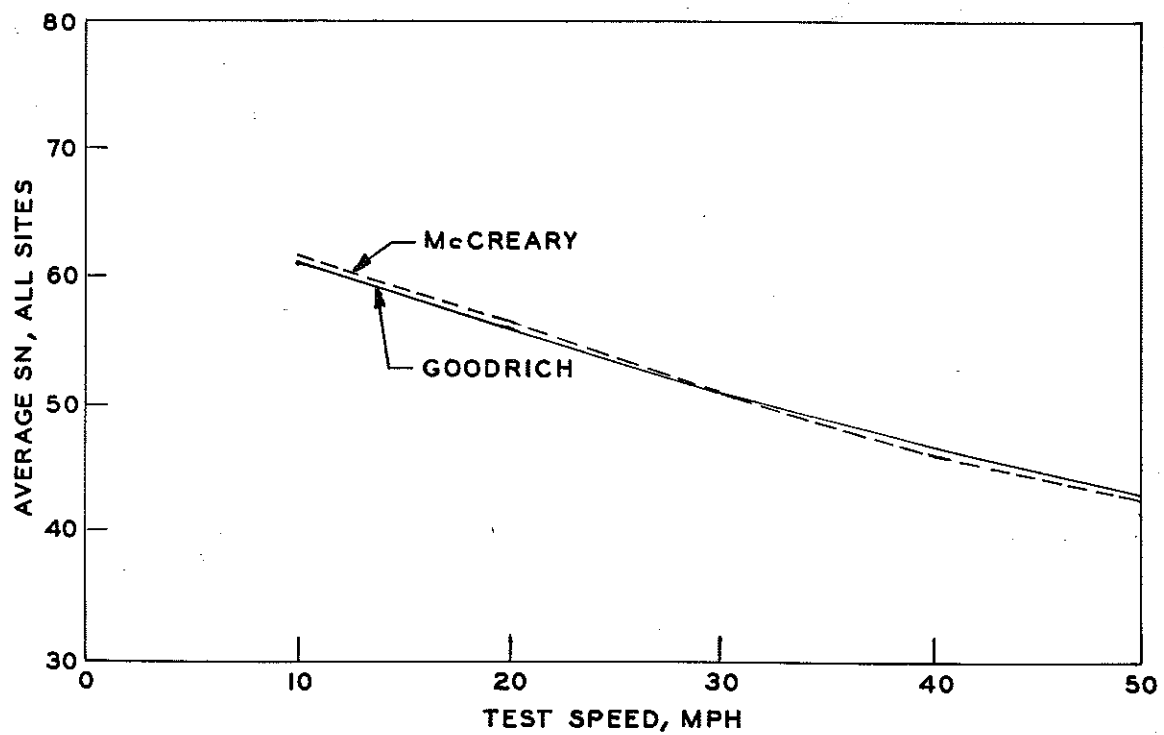


Figure 2. 1982 E501 Test Tire Comparison  
Test Speed vs. Average Friction Level  
(Combined Sites)