VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION SKID TESTING EQUIPMENT CORRELATION RESULTS 1974, 1975, and 1978

by

Stephen N. Runkle
Research Analyst

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway and Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways & Transportation and the University of Virginia)

Charlottesville, Virginia

September 1978

VHTRC 79-R17

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ABSTRACT

The purpose of this study was to modify, as required, the previously established relationships between the VHTRC skid trailer, the VHTRC stopping distance car, and the first VDHT skid trailer, and to develop appropriate relationships with the above three devices for the second, recently acquired VDHT trailer.

Regression equations indicating the relationships between the trailers are given below. In general these equations indicate that —

1. the relationships remain the same with changes in test speed, and from year to year; and

2. the relationships are essentially one to one, i.e., the slopes generally are not significantly different from 1.0 with some difference in average results as follows.

VDHT Trailer #1 = VDHT Trailer #2 + 2.5 SN

VDHT Trailer #1 = VHTRC Trailer - 3.0 SN

VDHT Trailer #2 = VHTRC Trailer - 7.0 SN

As expected, the SN values obtained with the trailers were less than the SDN values obtained with the car at the same initial test speed and the relationships differ with test speed. However, it is important to note that for these relationships the slopes generally do differ significantly from 1.0; i.e., the difference in measured values between the car and trailers is not constant from low to high levels of skid resistance, with the difference being larger on low skid resistance sites.

Since most survey skid data have been collected with VDHT Trailer #1, it seems reasonable to standardize results in terms of this test unit. Thus, survey data collected with the newer VDHT Trailer #2 should be corrected either in terms of adding 2.5 SN or by using equation 4 in Table 3 of the report. However, it should be pointed out that no correction of this type would result in a conservative (i.e. lower) interpretation of survey SN data.

Predictions of SDN values, or stopping distances, should be made based on equations 17-21, 25, or 30-34 from Table 2 of the report, depending on the test trailer used.

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INTRODUCTION

During the summer of 1974 a correlation study was performed to relate the Council's skid trailer used in research (VHTRC Trailer), the newly acquired skid trailer to be utilized for survey skid testing (VDHT Trailer #1), and the Research Council's stopping distance car (VHTRC Car); and a similar study was performed in the summer of 1975. The results of both studies were reported in "The Evaluation of the New VDHT Skid Testing Trailer" and "Methodology for Utilizing Survey Skid Data".[1,2]

Because three years had elapsed since the last correlation study and a second skid trailer (VDHT Trailer #2) had recently been obtained for survey testing, another correlation study was made in the spring of 1978. Additionally, because the VDHT Trailer #1 had been used for several years to collect survey data and will be used as the primary testing device on Virginia's wet accident reduction program, it seemed appropriate to designate this unit as the standard unit. Thus, regression equations relating testing units were developed with the VDHT Trailer #1 as the dependent variable, although this was not always done in the 1974 and 1975 studies.

PURPOSE AND SCOPE

The purpose of this study was to modify the previously established relationships between the VHTRC Trailer, the VDHT Trailer #1, and VHTRC Car as necessary based on new test results, and to develop appropriate relationships for the recently acquired VDHT Trailer #2. The scope of the study was limited to the primary test modes used in Virginia; namely, the test conforming to the ASTM locked-wheel method for skid trailers and the stopping distance method.

All test data were collected on the Lynchburg test loop (six sites), which is routinely used for control testing by the two VDHT trailers and was used in the two previous correlation studies. Tests were performed with both treaded tires and bald tires to provide as wide a range in measured skid resistance as possible and, for the most part, were run at 40 mph, the speed used for most testing in Virginia. Tests were run at multiple speeds with the VDHT trailers to verify that speed gradients were approximately the same for these units, with some repeat testing being performed at selected sites by these two trailers. Additionally, the 1974 and 1975 data were utilized in all analyses performed.

All 1978 testing was performed during late March and early April. Only limited results were obtained with the car because of mechanical problems, and data collected by the VHTRC Trailer during the first week of testing were later determined to be faulty because of malfunctions related to the brakes in the skid trailer. Later, when this problem had been corrected, tests were obtained with the three trailers. The results of all tests are discussed below.

RESULTS

The results of all tests made during the 1978 correlation study are shown in Table 1. Each value shown is the average SN value for five repeat tests at the site for the speed and test tire indicated. Correlation results in previous studies have customarily been based on average SN values (sample size of five) since for most purposes in Virginia reported test results are the average of at least five tests. As indicated previously, test data obtained by the VHTRC Trailer for the period 3/20/78 - 3/22/78 were determined to be faulty because of brake problems in the skid trailer, and thus are not shown in Table 1.

Table 2 contains all the regression equations developed based on 1978 data, 1974 and 1975 data, and combined 1974, 1975 and 1978 data. The equations as shown in Table 2 are numbered for reference purposes in the discussion below.

Table 1

Correlation Test Results — 1978
(Tests at 20, 40, 60 mph)

Site	Date	Tire	VDHT #1			VDHT #2			VHTRC Trailer			VHTRC Car		
			20	40	60	20	40	60	20	40	60	20	40	60
1	3-20-78	New*	50	36	28	50	37	29						
	3-21-78	Bald	35	16	9	30	14	7						
	3-21-78	New		45			42						54	
	3-21-78	Bald		15			12						29	
	4-3-78	New		42			39			45				
	4-3-78	Bald		20			16			25				
2	3-20-78	New	67	55	44	68	57	44						
	3-21-78	Bald	46	24	15	42	21	14						
	3-21-78	New		57			53						61	
	3-21-78	Bald		22			19						40	
	4-3-78	New		58			55			64				
	4-3-78	Bald		28			22			37				
3	3-22-78	New	64	52		62	49							
	3-22-78	Bald	50	31		44	27							
	4-3-78	New		52			51			58				
	4-3-78	Bald		36			30			39				
4	4-3-78	New		51			47			59				
	4-3-78	Bald		34			31			42				
5	3-22-78	New	60	42	35	57	42	32						
	3-22-78	Bald	35	18	10	32	19	13						
	3-21-78	New		44			41						53	
	3-21-78	Bald		17			15						38	
	4-3-78	New		46			42			44				
	4-3-78	Bald		24			20			25				
6	3-22-78	New	64	51	41	61	50	39						
	3-22-78	Bald	43	24	18	37	21	15						
	4-3-78	New		54			52			61				
	4-3-78	Bald		33			27			43				

*New Treaded Tire

Table 2

Regression Equations

Equation Number	Data Base	Test Speeds	Dependent Variable (y)	Independent Variable (x)	N	Regression Equation	r	s($\hat{y}$)	s(b)	$\bar{x}$	$\bar{y}$
1	1978	20 mph	VDHT 1	VDHT 2	10	y= 8.75+0.88x	.99	1.84	0.046	48.3	51.4
2		40 mph			28	y= 3.93+0.96x	.99	1.96	0.026	34.0	36.7
3		60 mph			8	y= 0.68+1.01x	.99	2.26	0.063	24.1	25.0
4		20, 40, 60			46	y= 2.94+0.99x	.99	2.19	0.021	35.4	37.8
5		20, 40, 60	VDHT 2	VDHT 1	46	y=- 2.24+1.00x	.99	2.15	0.020	37.8	35.4
6	1974	30, 40, 50, 60	VDHT 1	VHTRC Trailer	122	y=- 2.98+1.00x	.93	4.54	0.036	42.2	39.4
7	1975	30, 40, 60			36	y= 1.77+0.84x	.99	1.90	0.024	39.2	34.8
8	1978	40			12	y=- 1.68+0.92x	.96	3.53	0.081	45.2	39.8
9	1974-78	30, 40, 50, 60			170	y=- 1.47+0.96x	.94	4.21	0.027	41.8	38.4
10		30, 40, 50, 60	VHTRC Trailer	VDHT 1	170	y= 6.28+0.92x	.94	4.14	0.026	38.4	41.8
11	1978	40	VDHT 2	VHTRC Trailer	12	y=- 8.37+0.98x	.96	4.19	0.096	45.2	36.0
12		40	VHTRC Trailer	VDHT 2	12	y= 11.74+0.93x	.96	3.86	0.086	36.0	45.2
13	1974-78	30	VDHT 1	VHTRC Car	43	y=-14.6 +1.12x	.87	4.50	0.099	54.4	46.2
14		40			63	y=-15.5 +1.07x	.92	4.30	0.056	48.4	36.4
15		50			31	y=- 5.51+ .83x	.81	4.26	0.112	50.1	36.3
16		60			39	y=- 9.22+ .88x	.83	4.25	0.095	45.4	30.7
17		30	VHTRC Car	VDHT 1	43	y= 23.4 + .67x	.87	3.49	0.060	46.2	54.4
18		40			63	y= 20.0 + .78x	.92	3.67	0.043	36.4	48.4
19		50			31	y= 21.6 + .79x	.81	4.13	0.106	36.3	50.1
20		60			39	y= 21.1 + .79x	.83	4.08	0.087	30.7	45.4
21	1974-75	40, 60	(60 mph)	(40 mph)	39	y= 16.7 + .70x	.83	4.08	0.077	41.1	45.4
22	1978	40	VDHT 2	VHTRC Car	6	y=-33.4 +1.39x	.98	3.81	0.141	45.8	30.3
23		40	VHTRC Car	VDHT 2	6	y= 24.9 + .69x	.98	2.68	0.070	30.3	45.8
24		40	VDHT 2	VHTRC Car		y=-13.0 +1.07x					
25		40	VHTRC Car	VDHT 2		y= 18.0 + .78x					
26	1974-75	30	VHTRC Trailer	VHTRC Car	22	y=-17.81+1.23x	.92	4.31	0.116	53.9	48.6
27		40			37	y=-14.71+1.13x	.93	4.16	0.076	46.5	38.0
28	1974	50			10	y=-24.48+1.26x	.84	6.44	0.288	50.6	39.3
29	1974-75	60			18	y=-10.54+1.06x	.87	4.89	0.149	43.8	35.8
30		30	VHTRC Car	VHTRC Trailer	22	y= 20.34+0.69x	.92	3.27	0.066	48.6	53.9
31		40			37	y= 17.60+0.76x	.93	3.41	0.051	38.0	46.5
32	1974	50			10	y= 28.68+0.56x	.84	4.28	0.128	39.3	50.6
33	1974-75	60			18	y= 18.11+0.72x	.87	4.04	0.102	35.8	43.8
34		40, 60	(60 mph)	(40 mph)	18	y= 14.97+0.65x	.87	4.04	0.092	44.6	43.8

Relationships Between Trailers

One would expect the relationship between trailers to be essentially one to one at all test speeds. As will be discussed below, it is true that the relationship between trailers does not differ significantly from one test speed to another, nor does the slope of the regression relationship differ significantly from a slope of one. However, it appears the trailers do differ slightly on the average, as will be indicated.

VDHT Trailer 1 and VDHT Trailer 2

Equations 1 through 5 in Table 2 describe the relationship between the two VDHT trailers. Equations 1 through 3 describe relationships for the test speeds of 20, 40 and 60 mph, and are shown graphically in Figure 1. It is possible to test the significance of using a single slope for all test speeds versus using separate slopes for each speed by means of the F test as described by Volk.[3] In this case it was determined that no significant basis exists for using separate slopes, thus the equation inclusive of all tests speeds as shown in Figure 2 (equation 4 in Table 2) is appropriate for use. It can also be shown that on the basis of a t test the slope of the combined equation (0.99) is not significantly different from 1.0; thus it would be appropriate either to predict VDHT Trailer #1 from the equation or to simply add 2.5 SN to VDHT Trailer #2 results (2.5 SN is the approximate average difference between the two trailers).

Equation 5 in Table 2 describes the relationship between the two VDHT trailers with Trailer #2 as the dependent variable. As with equation 4, one may use equation 5 for prediction purposes or simply subtract 2.5 SN to obtain an estimated VDHT Trailer #2 SN from a VDHT Trailer #1 SN value.

VDHT Trailer 1 and VHTRC Trailer

Equations 6 through 10 in Table 2 describe the relationships between the VHTRC Trailer and VDHT Trailer #1 for the correlations performed in 1974, 1975, and 1978. Equation 6 (1974) is a composite equation for the test speeds 30, 40, 50, 60, and 70 mph, with no significant difference being found between the equations for each of these test speeds. Similarly, equation 7 is a composite equation for test speeds 30, 40, and 60 mph with, again, no significant difference being found between the equations for each test speed during 1975. Equation 8 is the equation derived from 1978 data with testing being performed at 40 mph only (VHTRC Trailer) as shown in Table 1. These three equations (6-8) are shown together in Figure 3.

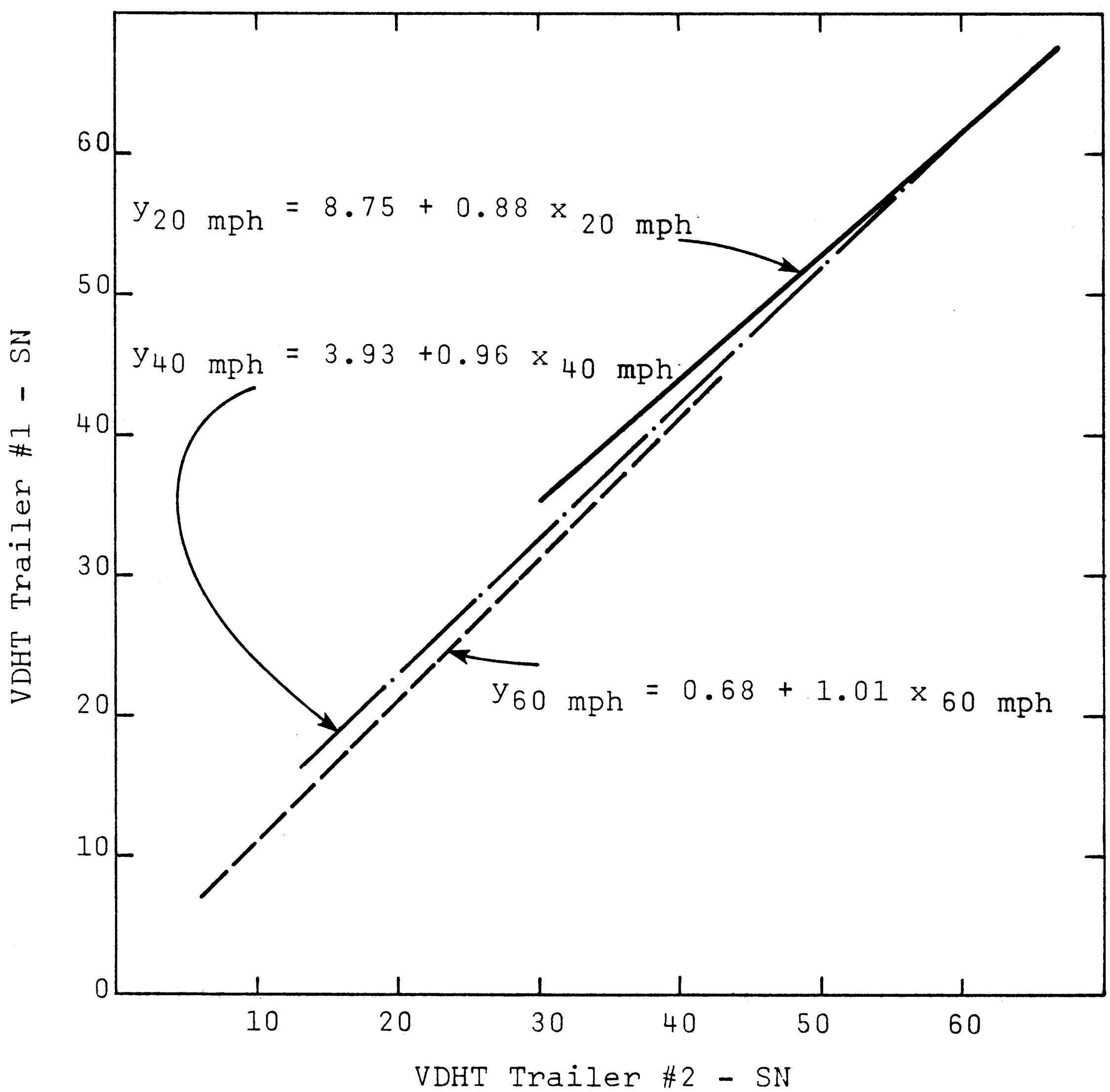

Figure 1. Relationship between VDHT Trailers #1 and #2 at 20, 40, and 60 mph.

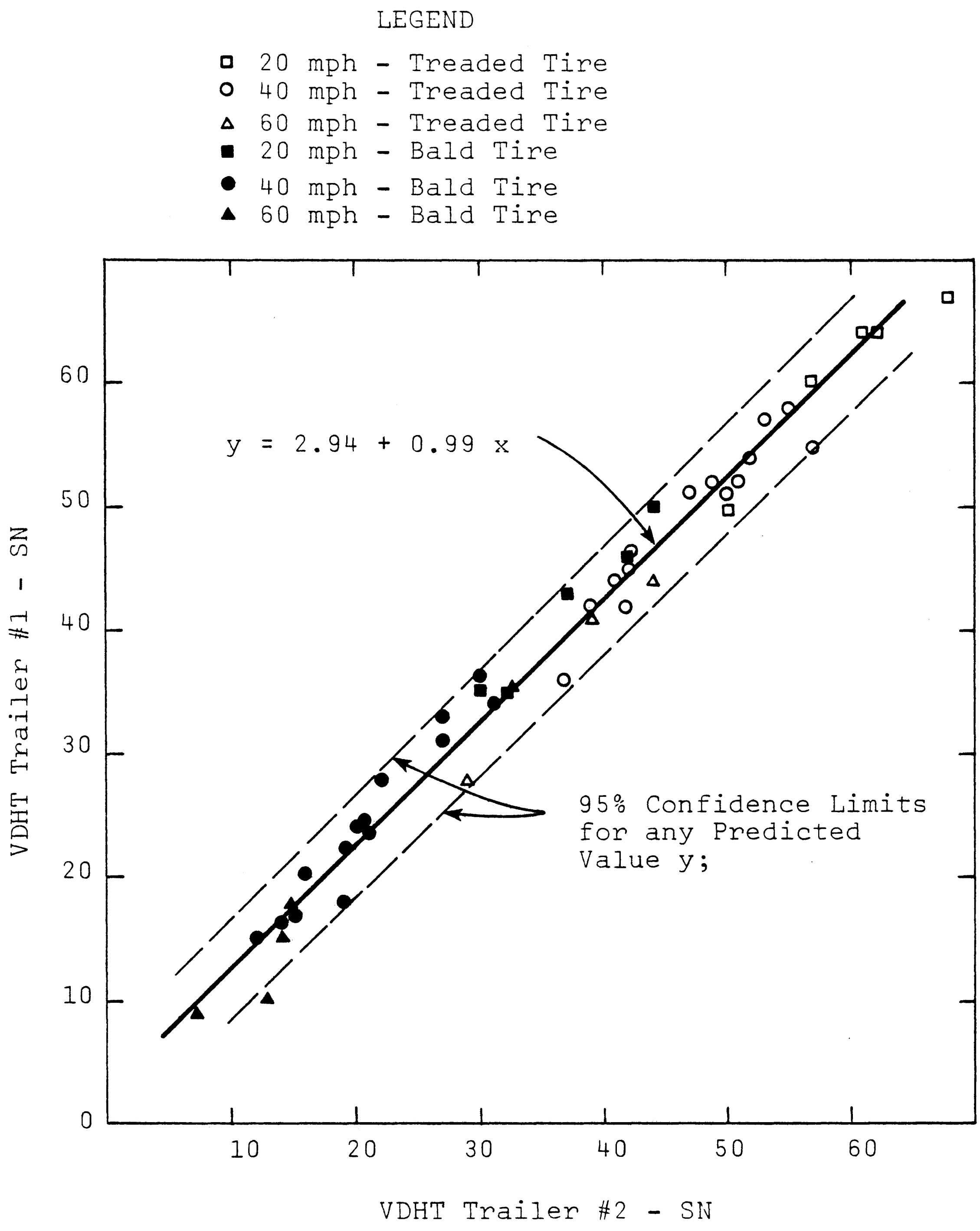

Figure 2. Relationship between VDHT Trailers #1 and #2 at all test speeds combined.

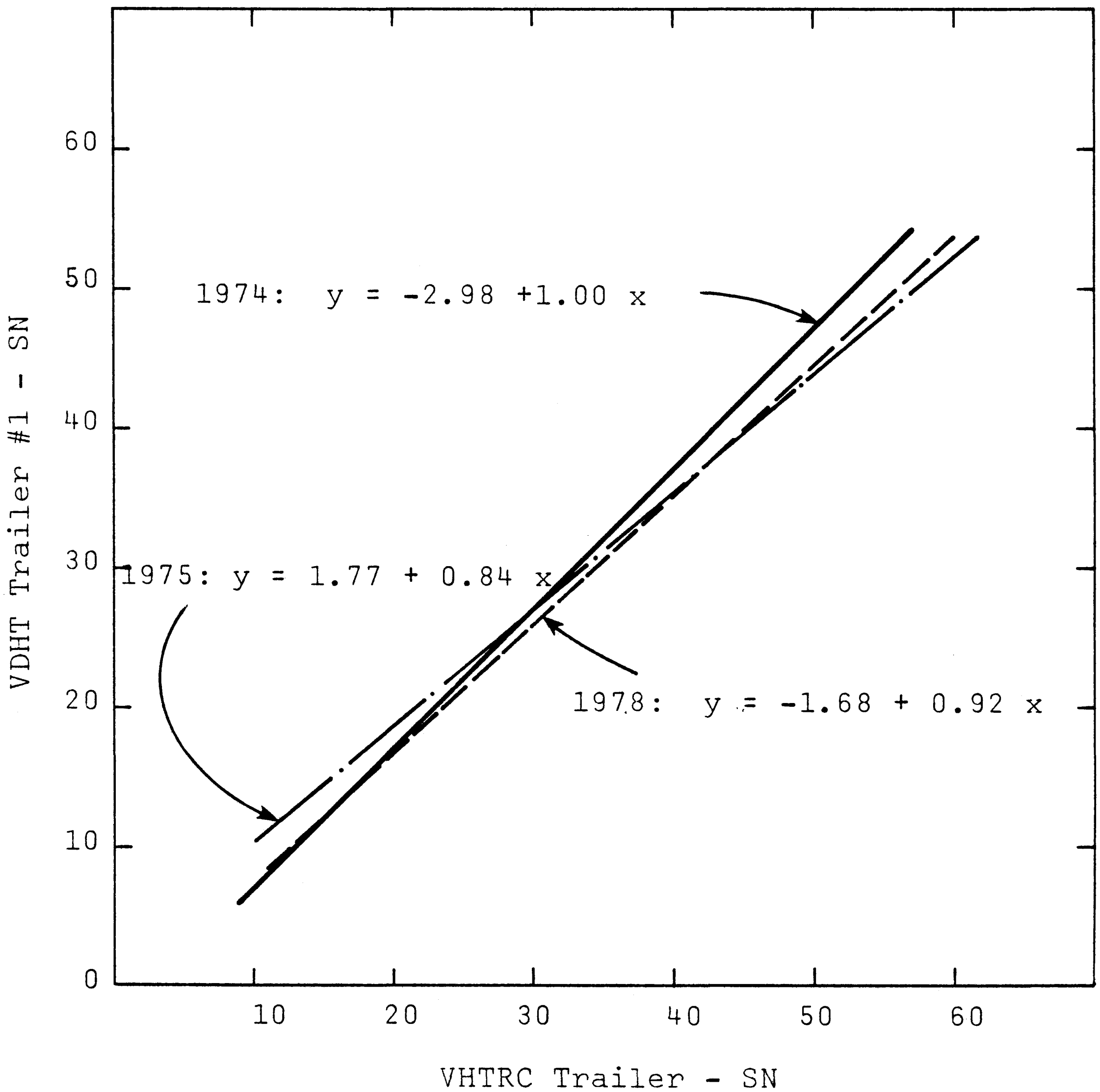

Figure 3. Relationships between VHTRC Trailer and VDHT Trailer #1 for 1974, 1975, and 1978.

Because of the large sample sizes involved, particularly for 1974 and 1975, the differences in the slopes of these curves were found to be significant at 95%, but not 99% (again by the method of test in Volk referenced above). However, in looking at Figure 3 it is clear that while the differences in the individual curves were judged to be statistically significantly different (principally the 1975 curve), there is only about a 2.0 SN maximum difference over the SN range from 20 to 40. Thus, unless some specific reasons were known for the slight year-to-year changes, it seems that a composite curve would be appropriate for use. In comparing the composite curve (equation 9) with the individual curves (Figure 3) the difference in the predicted VDHT Trailer #1 SN value by using the composite curve for any SN value of the VHTRC Trailer is generally no more than 1.0 SN. The composite slope of 0.96 was found to be significant at the 90% level; so, while a slightly better estimate may be made by using the regression equation, it is judged by the author to be satisfactory to predict VDHT Trailer #1 SN values from VHTRC Trailer SN values simply by subtracting about 3.0 SN.

Equation 10 describes the relationship with the VHTRC trailer as the dependent variable. For this equation the slope is significantly different from 1.0 at a 99% confidence level, which indicates the desirability of using the equation for prediction purposes. (As above, however, the maximum difference between the predicted VHTRC Trailer SN value when using the equation or when simply adding 3.0 SN to the VDHT Trailer #1 SN value is less than 2.0 SN.)

VDHT Trailer #2 and VHTRC Trailer

Only the twelve data points shown in Table 1 (1978 data) were available for developing the relationship between VDHT Trailer #2 and the VHTRC Trailer. All the data shown in Table 1 were obtained at 40 mph, so it is not possible to determine if the relationship remains the same for various test speeds. However, based on the trailer relationships discussed above, it is probable the 40 mph relationship would hold for other test speeds.

Equations 11 and 12 in Table 2 describe the relationship between VDHT Trailer #2 and the VHTRC Trailer. As for most of the equations previously discussed, the slopes for equations 11 and 12 are not significantly different from 1.0. Thus it would appear that one may predict VDHT Trailer #2 values from VHTRC Trailer values by subtracting about 9.0 SN. However, the true differences may be less as suggested by the relationships between the VHTRC Trailer and VDHT Trailer #1 (equations 6-10). For these two trailers the average difference in 1978 was 5.4 SN, which was reduced to 3.4 when 1974 and 1975 data were also considered. This reduction suggests that the difference between the trailers during the 1978 test period may have been relatively high. Thus, a more appropriate correction factor may be 7.0 SN, but this value should be verified through additional correlation testing.

Relationships Between Trailers and Stopping Distance Car

As is well known, SN changes with speed, which means it should be expected that SN values obtained by a locked-wheel skid trailer at a constant speed would differ from the SN values obtained with a stopping distance car from the initial speed to a speed of zero. In fact, Giles has shown that SN levels obtained with a stopping distance car should be equivalent to those obtained with a trailer at two-thirds the initial car test speeds.[4] That is, where SN is the trailer skid number and SDN the stopping distance skid number,

$$SN_{30} = SDN_{45},$$

$$SN_{40} = SDN_{60},$$

$$SN_{50} = SDN_{75}, \text{ and}$$

$$SN_{60} = SDN_{90}, \text{ or}$$

$$SDN_{30} = SN_{20},$$

$$SDN_{40} = SN_{26.7},$$

$$SDN_{50} = SN_{33.3}, \text{ and}$$

$$SDN_{60} = SN_{40}.$$

It follows that

$$SN_{30} = SDN_{30} - \Delta_1,$$

$$SN_{40} = SDN_{40} - \Delta_2,$$

$$SN_{50} = SDN_{50} - \Delta_3, \text{ and}$$

$$SN_{60} = SDN_{60} - \Delta_4, \text{ or}$$

$$SDN_{30} = SN_{30} + \Delta_1,$$
$$SDN_{40} = SN_{40} + \Delta_2,$$
$$SDN_{50} = SN_{50} + \Delta_3,$$
$$SDN_{60} = SN_{60} + \Delta_4, \text{ where}$$

Δ_1 = the decrease in SDN from 45 mph to 30 mph, or the increase in SN from 30 to 20 mph;

Δ_2 = the decrease in SDN from 60 mph to 30 mph, or the increase in SN from 40 to 26.7 mph;

Δ_3 = the decrease in SDN from 75 mph to 50 mph, or the increase in SN from 50 to 33.3 mph; and

Δ_4 = the decrease in SDN from 90 mph to 60 mph, or the increase in SN from 60 to 40 mph.

Obviously, the values Δ_1 through Δ_4 are dependent on the SN or SDN - speed gradient values. From the multiple speed SN data in 1974, 1975, and 1978 the average trailer gradients were computed as shown in Table 3 with corresponding values for Δ_1 through Δ_4.

Thus, the equations above would become

$$SN_{30} = SDN_{30} - 7.0,$$
$$SN_{40} = SDN_{40} - 9.2,$$
$$SN_{50} = SDN_{50} - 10.9, \text{ and}$$
$$SN_{60} = SDN_{60} - 11.0.$$

The implied gradients for the car would be as shown in Table 4 for the values of Δ_1 through Δ_4 (also shown are estimated values for Δ_1 and Δ_2 gradients, based on 1974 and 1975 data).

The relationships between the trailers and car will be considered relative to the last four equations above, with the expectation that the car should yield higher values for a given test speed.

Table 3

Trailer Gradients

Speed Range, mph	1974		1975		1978		Average Values	Corresponding Value of			
	VDHT 1	VHTRC	VDHT 1	VHTRC	VDHT 1	VDHT 2		Δ_1	Δ_2	Δ_3	Δ_4
20-40	.63[a]	.70[a]	.65[a]	.67[a]	.82	.68	.69	7.0	9.2	-	-
30-50	.58	.52					.63[b]	-	-	10.9	-
40-60	.55	.46	.73	.77	.41	.44	.56	-	-	-	11.0

[a] 30-40 mph values

[b] Average of 0.69 and 0.56

Table 4

Stopping Distance Car Gradients

Δ Values	Corresponding SDN Speed Range, mph [a]	Implied Gradient	Actual Gradient[b]
Δ_1 = 7.0	30 - 45 mph	0.47	0.37
Δ_2 = 9.2	40 - 60 mph	0.46	0.35
Δ_3 = 10.9	50 - 75 mph	0.44	-
Δ_4 = 11.0	60 - 90 mph	0.37	-

[a] For initial test speed

[b] Estimated based on 1974 and 1975 data

VDHT Trailer #1 and VHTRC Car

Combined results for all tests run at 30, 40, 50, and 60 mph in 1974, 1975, and 1978 were used to develop equations 13 through 16 in Table 2. Of the four equations, none have slopes significantly different from 1.0 at more than an 85% level of significance. Thus, setting the slope equal to 1.0 and taking the average difference in SN values yields

$$SN_{30} = SDN_{30} - 8.2,$$

$$SN_{40} = SDN_{40} - 12.0,$$

$$SN_{50} = SDN_{50} - 13.8, \text{ and}$$

$$SN_{60} = SDN_{60} - 14.7.$$

These equations, while not identical to the theoretical equations listed above, follow the same pattern as the theoretical equations in that the correction factor increases as the test speed increases. Differences in predicted SN values are generally no more than 2.0 - 3.0 SN for the SDN range 25-60, depending on whether one uses the regression equations 13-16 in Table 2 or the modified equations above with a slope of 1.0.

With the VHTRC Car as the dependent variable (equations 17-20, Table 2), the slopes do differ significantly from 1.0. In this case the SDN values may differ by as much as 6.0 to 8.0 for the SN range 20-60, depending on whether one uses the regression equations 17-20 or the four equations above.

In essence, the difference between the VHTRC Car and VDHT Trailer #1 is greater for low skid resistance pavements than for high skid resistance pavements, as can be seen by plotting any of the equations 13-20. This, of course, is a reasonable occurrence because the gradient is no doubt generally higher for low skid resistance pavements. It does, however, mean that for prediction purposes it is desirable to use regression equations 13-20.

One additional relationship of interest between these two testing devices was evaluated. Since normal trailer survey testing is at 40 mph, the theoretical discussion above would indicate the SN_{40} values are equivalent to SDN_{60} values, or the SDN values that would be obtained at the approximate speed limit for primary and interstate highways. This relationship is shown as equation 21 in Table 2. While the average difference is only

4.3 SN, with the trailer yielding the lower values, the slope is significantly different from 1.0. As in the other equations with the car as the dependent variable, the difference is greater at low skid resistance sites (see Figure 4). In this case, the greater difference at lower skid resistance sites is probably because at these sites the lateral change in skid resistance is higher than at sites with high measured skid resistance (i.e. the skid resistance in the wheel path is relatively less), and the car, by testing with all four wheels and, at times, tending to slide out of the wheel paths, would likely measure relatively higher values than would the trailer.

VDHT Trailer #2 and VHTRC Car

As shown in Table 1, only six data points (all at 40 mph) were obtained during the 1978 testing upon which to develop the relationship between the VHTRC Car and VDHT Trailer #2. However, one would expect the relationship to be very similar to that between the car and VDHT Trailer #1, since the two VDHT trailers relate very well (equations 1-16, Table 2).

Equations 22 and 23 show the relationships between the car and VDHT Trailer #2 based on the limited 1978 data. While equations 22 and 23 look somewhat different from equations 14 and 18, the differences in slopes are not statistically significant at a high level of significance. Also, if only 1978 data are considered, the relationships between each of the two VDHT trailers and the car are very similar, as shown in Figures 5 and 6. In fact, for the 1978 relationships the only difference is essentially the average difference between the two trailers of about 2.5 SN. Thus, it seems appropriate to approximate relationships between VDHT Trailer #1 and the VHTRC Car based on equations 14 and 18. These approximations, shown as equations 24 and 25 in Table 2, should be verified by additional testing, with additional testing also being required for relationships at speeds other than 40 mph.

VHTRC Trailer and Car

Only data from 1974 and 1975 were available for determining relationships between the VHTRC Trailer and VHTRC Car (no additional data for this purpose were obtained during the 1978 testing). Based on the data from 1974 and 1975 equations 26-34 in Table 2 were developed, and they exhibit the same basic trends as the equations for the relationships between VDHT Trailer #1 and the VHTRC Car (equations 13-21).

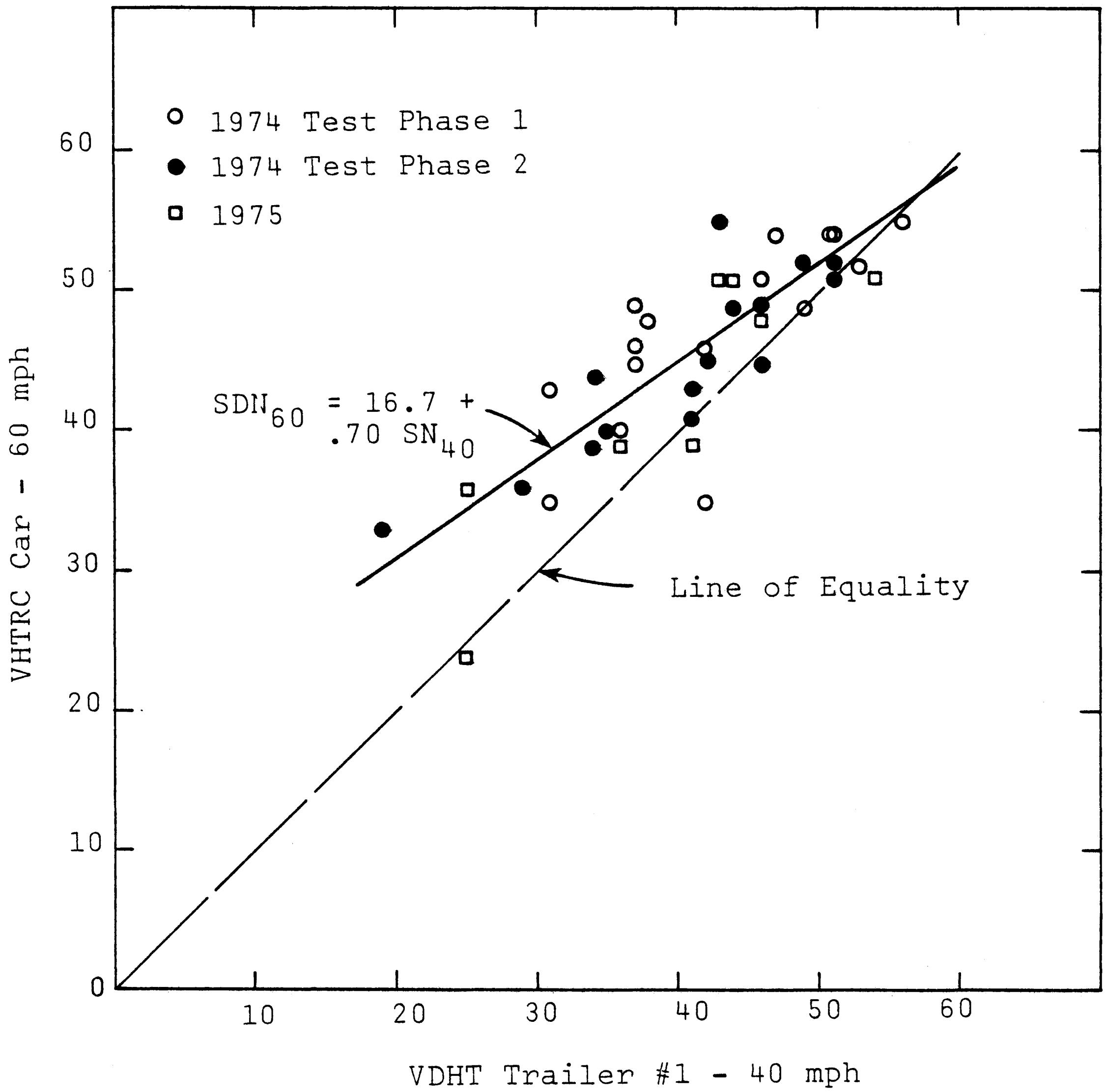

Figure 4. Relationship of VHTRC Car at 60 mph and VDHT Trailer #1 at 40 mph.

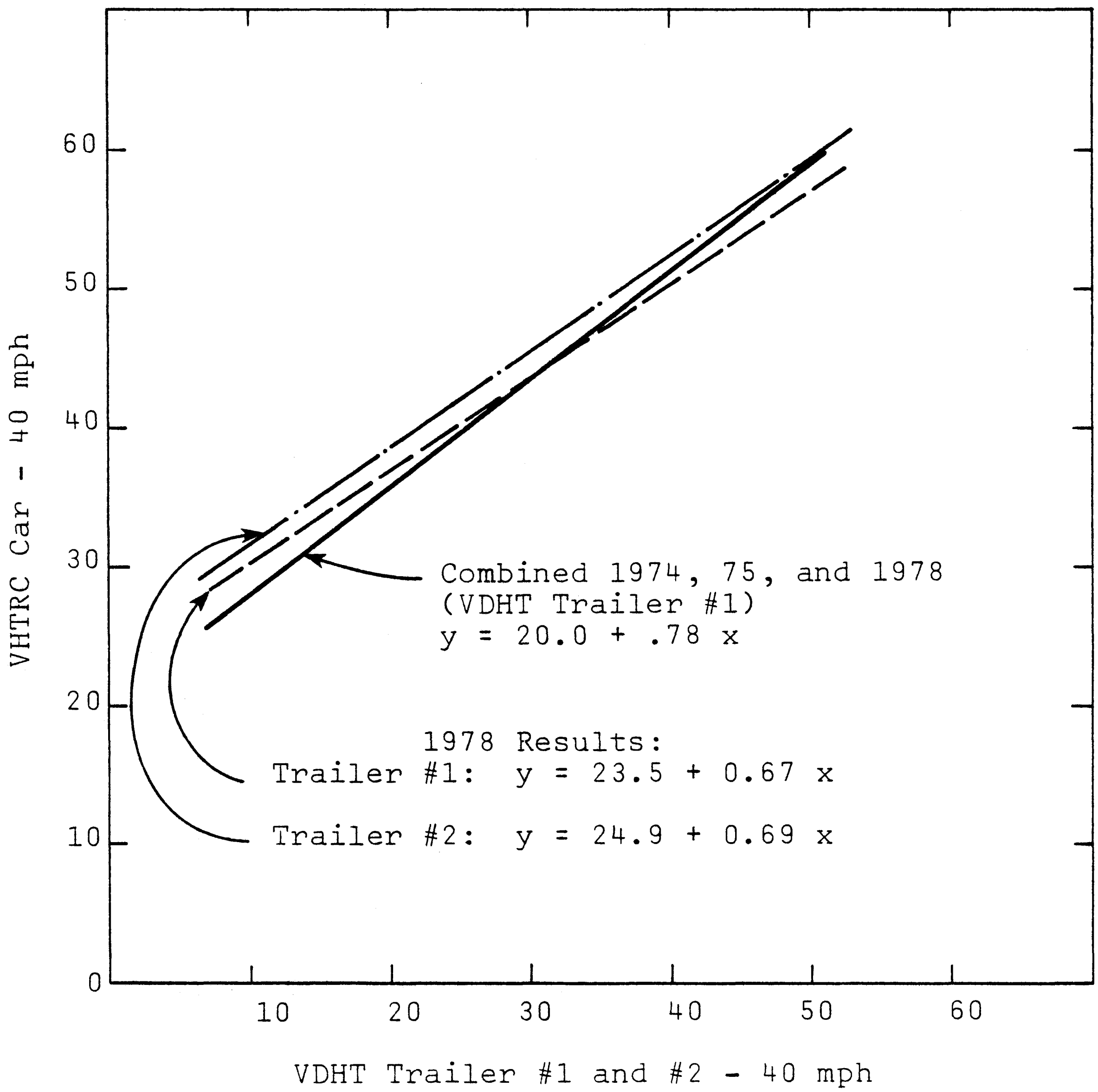

Figure 5. 1978 regression equations for VDHT Trailers and VHTRC Car, and combined 1974, 75, and 78 relationship between Trailer #1 and VHTRC Car with VHTRC Car as dependent variable.

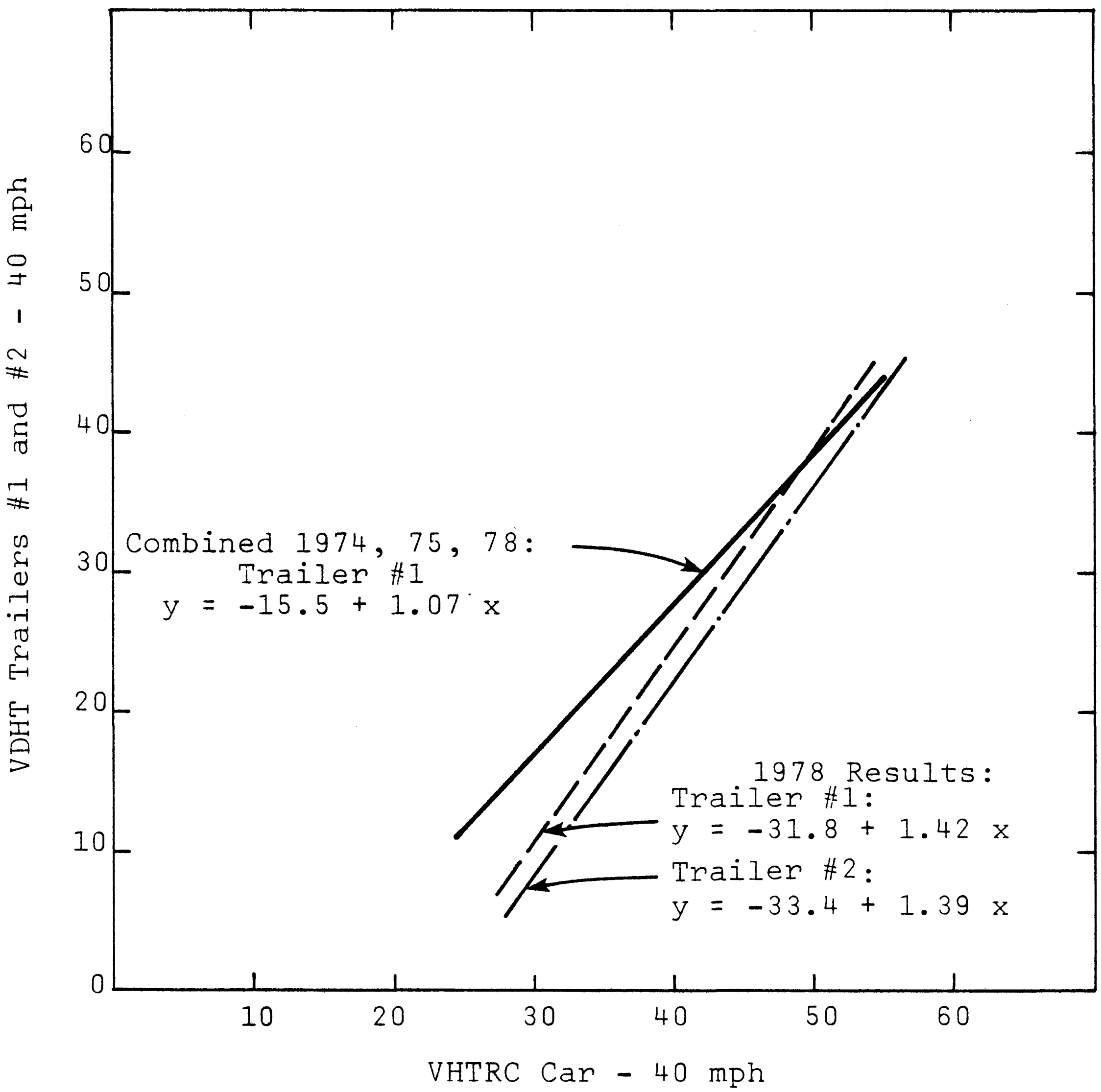

Figure 6. 1978 regression equations for VDHT Trailers and VHTRC Car, and combined 1974, 75, and 78 relationship between Trailer #1 and VHTRC Car with VDHT Trailers as dependent variable.

That is, setting, the slope of the curves equal to 1.0 would yield

$$SN_{30} = SDN_{30} - 5.3,$$

$$SN_{40} = SDN_{40} - 8.5,$$

$$SN_{50} = SDN_{50} - 11.3, \text{ and}$$

$$SN_{60} = SDN_{60} - 8.0.$$

The above equations are not too different from the theoretical equations discussed at the beginning of this section, but are not desirable for use because, in fact, the slopes of the regression equations frequently do differ significantly from 1.0 at high levels of significance, particularly with the VHTRC Car as the dependent variable. The probable reasons for the differences of the slopes from 1.0 were discussed previously.

The relationship of the car at 60 mph to the trailer at 40 mph was again determined as shown in equation 34. As the previous discussion would indicate, the average test result is about the same (44.6 SN for the trailer versus 43.8 SN for the car), but again the slope is significantly different from 1.0, with the car getting relatively higher values on low skid resistance pavements (Figure 7).

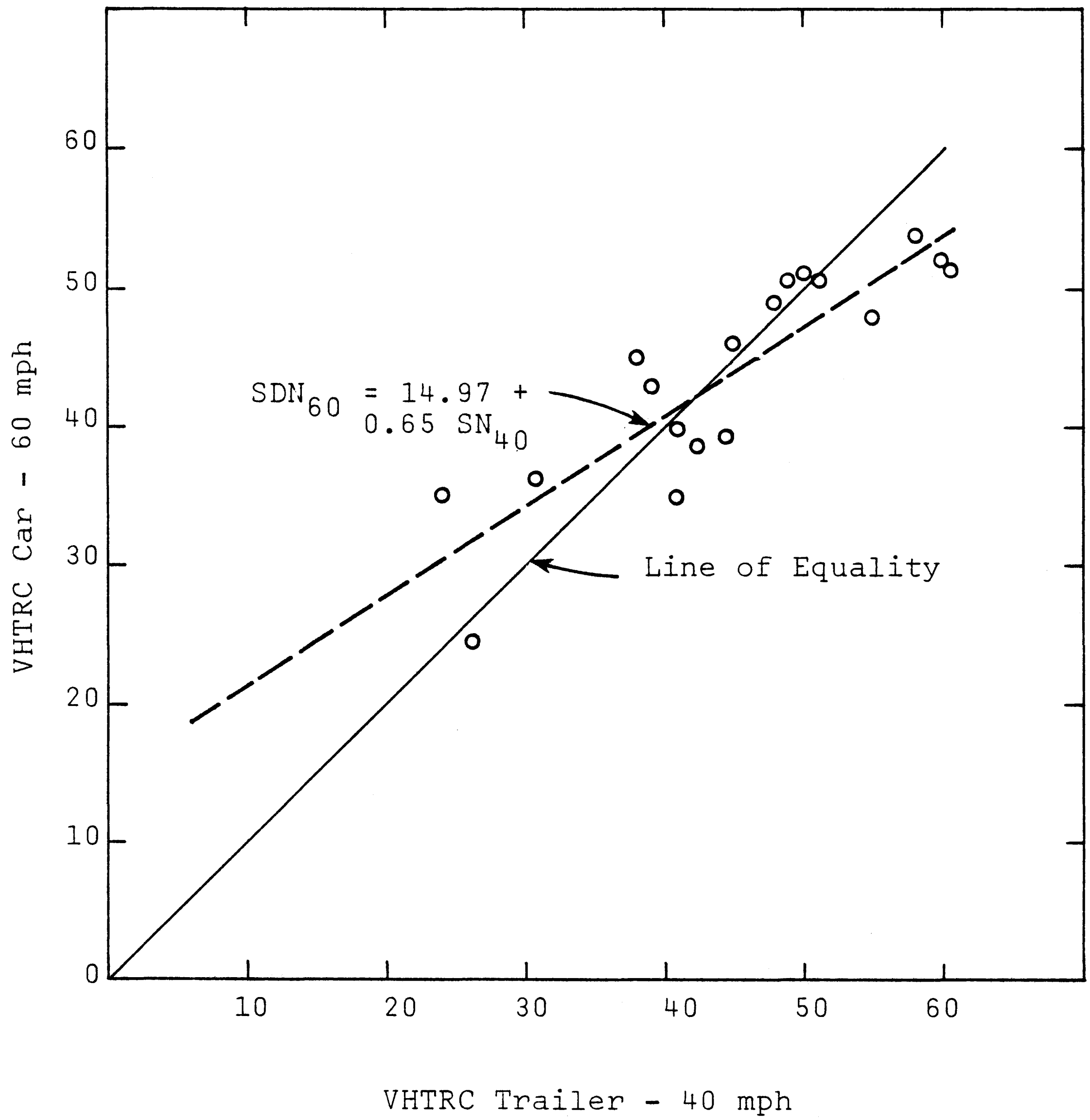

Figure 7. Relationship of VHTRC Car at 60 mph and VHTRC Trailer of 40 mph.

CONCLUSIONS AND RECOMMENDATIONS

Below are conclusions and recommendations based on the results of this study as discussed above.

Conclusions

Regression equations indicating the relationships between the trailers are shown in Table 2. In general these equations indicate that —

1. the relationships remain the same with changes in test speed, and from year to year; and

2. the relationships are essentially one to one, i.e., the slopes generally are not significantly different from 1.0, with some difference in average results as follows:

   VDHT Trailer #1 = VDHT Trailer #2 + 2.5 SN

   VDHT Trailer #1 = VHTRC Trailer - 3.0 SN

   VDHT Trailer #2 = VHTRC Trailer - 7.0 SN.

As expected the SN values obtained with the trailers were less than the SDN values obtained with the car at the same initial test speed and the relationships differ with test speed. (Regression equations describing the relationships between the car and trailers are also shown in Table 2.) However, it is important to note that for these relationships the slopes generally do differ significantly from 1.0; i.e., the difference in measured values between the car and trailers is not constant from low to high levels of skid resistance with the difference being larger on low skid resistance sites.

Recommendations

Since most survey skid data have been collected with VDHT Trailer #1 it seems reasonable to standardize results in terms of this test unit. Thus, survey data collected with the newer VDHT Trailer #2 should be corrected either in terms of adding 2.5 SN or by using equation 4 in Table 3. However, it should be pointed out that no correction of the type just mentioned would result in a conservative (i.e. lower) interpretation of survey SN data.

Predictions of SDN values, or stopping distances, should be made based on equations 17-21, 25, or 30-34 from Table 2, depending on the test trailer used.

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