



TECHNICAL REPORT

J880a

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BRAKE RATING SYSTEM TEST CODE —
COMMERCIAL VEHICLES — SAE J880a

SAE Recommended Practice

Report of Brake Committee approved November 1963 and last revised June 1970.

1. Purpose—The purpose of this code is to provide a method for determining a brake system rating for new commercial highway vehicles, based on the energy absorption and dissipation capacity of the brake system as established by a repeated test procedure.

2. Scope—This code is intended for vehicles with brake systems having typical service pressure ranges 0-1800 psi hydraulic or 0-120 psi air and is not directly applicable to vehicles with other systems.

2.1 The code provides test procedures and instructions for:

2.1.1 Instrumentation and equipment.

2.1.2 Vehicle preparation.

2.1.3 Determining brake system energy absorption capacity.

2.1.4 Calculation of brake rating.

2.2 The code includes provision for those single unit, combination, and special vehicles which cannot be loaded to the manufacturer's rated gross vehicle weight, or cannot be accelerated in the time interval required, or cannot attain the specified 50 mph speed.

2.3 Methods for measuring energy absorption capacity, other than described herein, may be equally valid.

3. Instrumentation and Equipment—Each vehicle to be checked must be equipped with:

3.1 A "U" tube decelerometer.

3.2 A fifth wheel speed indicator or calibrated speedometer or tachometer.

3.3 A detonator or equivalent to measure stopping distance.

3.4 A calibrated line pressure gage.

3.5 A 50 ft tape.

3.6 A stop watch or timing device.

3.7 A brake thermocouple selector switch and a 0-1000 F direct reading pyrometer. Brake temperature measurement equipment and thermocouple installation to conform to SAE J843, except the plug type thermocouple shall be recessed 0.025 ± 0.005 in.

3.8 Provision for reservoir pressure control to limit service line pressure to the maximum permitted.

3.9 Shutoff valves to permit cutoff of front and/or rear brakes.

4. Vehicle Information and Data

4.1 Vehicle Information Sheet (Fig. 1) to be filled in prior to starting test.

4.2 Brake Rating Test Data Sheet (Fig. 2) for use during the tests. It should be noted that the maximum individual brake temperatures are not to be used as criteria for brake rating. The measurement of brake temperatures as an index of brake condition during the test is necessary to provide test control and aid in analyzing test results.

4.3 Work Sheet—Correction factors (Fig. 3) to be filled out and used as required per paragraph 7.2.

4.4 Data Sheet—Brake balance test (Fig. 4) to be filled out and used when running the brake balance test (paragraph 7.4).

5. Vehicle Condition—To rate the brake system properly, the vehicle should:

5.1 Be loaded to rated gvwt. The weight must be distributed as closely as possible to load each axle to its rated load. The center of gravity should be kept as low as possible. This can be accomplished by the proper selection of chassis, wheelbase, and type of weight used.

5.2 Be equipped with the largest production engine available for the chassis being tested.

NOTE: If sufficient engine horsepower is not available to obtain some evidence of brake fade, then vehicle weight or deceleration rate correction must be made in accordance with paragraph 7.2.

5.3 Have new or relatively new tires.

5.4 Have sufficient brake balance to obtain not less than 12 fpsps deceleration (U-tube decelerometer) without locking any wheel. (Brakes to be adjusted to manufacturer's specifications.)

VEHICLE INFORMATION SHEET					
TEST NO.	REQUIRED BRHP		TEST BRHP		
TEST FACILITY AND LOCATION					
VEHICLE MAKE AND MODEL					
ESTIMATED CENTER OF GRAVITY OF BODY AND TEST LOAD ABOVE GROUND					
WEIGHT DISTRIBUTION: FRONT AXLE		REAR AXLE(S)		TOTAL	
				TRAILER AXLE(S)	
				GROSS TOTAL	
SPECIAL CONDITIONS WHICH MIGHT AFFECT BRAKE PERFORMANCE					
ARE BACKING PLATES OR DUSTSHIELDS INSTALLED? FRONT REAR TRAILER					
TIRE SIZE: FRONT		MEASURED STATIC ROLLING RADII: FRONT			
REAR		REAR			
TRAILER		TRAILER			
TYPE OF WHEELS: FRONT REAR TRAILER					
(CAST STEEL SPOKE, STEEL DISC, ALUM. DISC, ETC.)					
TYPE OF RIM: FRONT REAR TRAILER					
(FLAT BASE, DROP CENTER, ETC.)					
BRAKE DRUM:		WEIGHT	TYPE	MAKE	PART NO.
FRONT					
REAR-FORWARD					
REAR-REAR					
TRAILER					
BRAKES:		SIZE	MAKE	TYPE	ASSY. NO.
FRONT					
REAR-FORWARD					
REAR-REAR					
TRAILER					
ACTUATION DETAILS: (FILL OUT PER HEADINGS FOR EITHER HYDRAULIC OR AIR BRAKES)					
IF HYDRAULIC:		VACUUM BOOSTER OR AIR CHAMBER TYPE AND SIZE	PEDAL RATIO AND USABLE TRAVEL SLACK ADJUSTER LENGTH OR WEDGE ANGLE	MASTER CYLINDER DIA AND STROKE	WHEEL CYLINDER DIA(S) CAM ROTATION (WITH OR OPPOSITE DRUM)
IF AIR:		AIR CHAMBER TYPE & SIZE		CAM RADIUS	
FRONT					
REAR-FORWARD					
REAR-REAR					
TRAILER					
ADJUSTMENT: (AUTOMATIC) (MANUAL)		FRONT	REAR-FORWARD	REAR-REAR	TRAILER

FIG. 1—VEHICLE INFORMATION SHEET

5.5 Be equipped with new or unburnished production linings which shall then be burnished as follows:

5.5.1 FOR VEHICLES 10,000 LB GVW AND UNDER—Make 200 brake applications at 40 to 20 mph at 10 fpsps, except the 10th snub and every 10th snub thereafter (10th, 20th, 30th, etc.) shall be from 50 to 15 mph at 12 fpsps. All snubs shall be made at 1 mile intervals (transmission in neutral or clutch disengaged). The vehicle shall be driven at 40 mph between brake applications. Directly following the 200th application, make 10 applications from 50 to 15 mph at 12 fpsps at 2 minute intervals.

5.5.2 FOR VEHICLES OVER 10,000 LB GVW—Make 500 brake applications (transmission in neutral or clutch disengaged) in accordance with Table 1. When, during any series, the hottest brake reaches 500 F, continue at that snub condition for an accumulated total of 500 burnish snubs, except that a higher or lower energy snub condition shall be followed when necessary to maintain a temperature of 500 ± 50 F. Record temperature immediately following each snub.

Use velocity and deceleration corrections when required for axle-by-axle or vehicle-by-vehicle tests of combinations. Drive as nearly as possible at the uncorrected indicated velocity between snubs, drifting to the proper corrected velocity before each snub.

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FIG. 2—TEST DATA SHEET

WORK SHEET - CORRECTION FACTORS FOR LOADS OTHER THAN THE RATED CAPACITY OF THE AXLE(S) OR VEHICLE(S)			
VEHICLE: TRUCK _____ TRACTOR _____ FULL TRAILER _____ SEMI-TRAILER _____			
MAKE _____ MODEL _____			
CALCULATED BY _____ DATE _____			
VELOCITY CORRECTION (FOR BURNISH AND RATING TEST)			
Y = _____ BRAKING PERCENTAGE ON THE TEST AXLE(S) OR VEHICLE(S) (FROM BRAKE BALANCE TEST).			
V ₁ = _____ STANDARD VELOCITY FROM WHICH RETARDATION STARTS WHEN OPERATED AT RATED GVW, MPH.			
V ₂ = _____ STANDARD VELOCITY AT WHICH BRAKES ARE RELEASED, MPH.			
W = _____ RATED GVW OF THE VEHICLE ON TEST (TRUCKS, TRACTORS AND FULL TRAILERS), LB.			
W ₁ = _____ RATED LOAD OF THE TEST AXLE(S) (SEMI-TRAILERS), LB.			
W ₂ = _____ TOTAL WEIGHT BEING RETARDED BY THE BRAKES ON THE TEST AXLE(S), LB.			
V ₃ CORRECTED TEST VELOCITY TRUCKS, TRACTORS AND FULL TRAILERS = $\sqrt{\frac{Y}{100} \times [V_1^2 - V_2^2] \times \frac{W}{W_2} + V_2^2}$ = _____ MPH			
V ₃ CORRECTED TEST VELOCITY SEMI-TRAILERS = $\sqrt{\frac{Y}{100} \times [V_1^2 - V_2^2] \times \frac{W_1}{W_2} + V_2^2}$ = _____ MPH			
DECCELERATION CORRECTION (FOR BURNISH AND RATING TEST)			
d = STANDARD DECCELERATION			
d ₁ CORRECTED DECCELERATION TRUCKS, TRACTORS AND FULL TRAILERS = $\frac{Y}{100} \times \frac{V_1 \times d}{V_3} \times \frac{W}{W_2}$			
d ₁ CORRECTED DECCELERATION SEMI-TRAILERS = $\frac{Y}{100} \times \frac{V_1 \times d}{V_3} \times \frac{W_1}{W_2}$			
STANDARD STOPPING DISTANCE CORRECTION			
S = MAXIMUM STANDARD STOPPING DISTANCE			
S ₁ CORRECTED MAXIMUM STANDARD STOPPING DISTANCE — TRUCKS, TRACTORS AND FULL TRAILERS = $\frac{100}{Y} \times \frac{W_2}{W} \times S$			
S ₁ CORRECTED MAXIMUM STANDARD STOPPING DISTANCE — SEMI-TRAILERS = $\frac{W_2}{W_1} \times S$			

FIG. 3—WORK SHEET—CORRECTION FACTORS (FOR LOADS OTHER THAN RATED CAPACITY OF AXLE(S) OR VEHICLE(S))

TABLE 1

Series	Snubs	Snub Conditions, at 1 mile intervals at 10 fpsps (or maximum possible less than 10)
1	175	40 to 20 mph
2	25	45 to 20 mph
3	25	50 to 20 mph
4	25	55 to 20 mph
5	25	60 to 20 mph

6. Rating Procedure

NOTE: The Brake Balance Test (paragraph 7.4) required for combining individual axle or vehicle ratings shall be run prior to the Rating Test. It may be run optionally only at this point on single-unit vehicles for information purposes.

6.1 General

6.1.1 It is recommended that brakes be readjusted to the manufacturer's specifications after burnish.

6.1.2 Three Rating Tests must be run before a rating can be established. The two initial tests are run at reduced energy input levels to condition the lining material further and to familiarize the driver and observer with the test procedure prior to the qualifying test (s).

6.1.3 Starting temperature (hottest brake) must be 150-200 F for conditioning prior to Cold Stop (s). Drift Time, Rating Tests, and Cooled Stop. It is recommended that the depth of thermocouple recess be maintained at 0.025 ± 0.005 in. prior to each test.

6.1.4 All brake applications in the following Test Sequence shall be made with the transmission in neutral or the clutch disengaged.

6.1.5 Record all data on Test Data Sheet (Fig. 2).

6.2 Test Sequence

6.2.1 TEMPERATURE CONDITIONING—Whenever Temperature Conditioning of the vehicle is required (for example; prior to the first test of the day), it shall consist of a series of snubs from 50 to 15 mph at 12 fpsps at 2 mile intervals (using corrected velocities and decelerations where applicable) until the 150-200 F temperature range for hottest brake is attained.

6.2.2 DRIFT TIME—The Drift Time shall be determined immediately following Temperature Conditioning (at 150-200 F hottest brake). The average Drift Time is determined by letting the vehicle coast (transmission in neutral) from 50 mph, or as corrected, to 15 mph. This value must be obtained in the same direction or directions with respect to the wind encountered during the test.

6.2.3 COLD STOP—Make three stops from 20 mph at sufficient deceleration to meet the Cold Stop distance requirement. The maximum service line pressure used shall not exceed 108 psi for vehicles with air brakes or 1800 psi for vehicles equipped with hydraulic brakes.

6.2.4 RATING TESTS—For rating purposes, a maximum of only five Rating Tests are permitted on a specific set of linings. For the first test, select from Table 2 the approximate number of snubs for the gv of the vehicle being tested. Snubs should be made in accordance with the brake apply time shown in Table 3, thus continually compensating for fractions of seconds.

Continue with the second and subsequent tests, each increasing in severity as required for proper brake rating. Rating Tests 1 and 2 are to be completed without regard to limiting criteria. A fourth and fifth Rating Test may be run as an option as shown in Table 4.

The rating shall be calculated on the basis of the last test on which the limiting criteria are not exceeded. For determining BRHP beyond the formula requirement, additional groups of five Rating Tests may be conducted on new sets of linings by starting Rating Test 1 at a greater number of snubs than was used in the compliance Rating Test.

To start the Rating Test, bring the vehicle to 15 mph. Start the stop watch and accelerate vehicle to 50 mph or to the corrected velocity as quickly as possible. Make the predetermined number of snubs to 15 mph attempting to maintain a 12 fpsps or corrected deceleration at the proper time cycle. Do not use over 90 psi service line air pressure or 1500 psi hydraulic pressure on any snub.

6.2.5 Hot Stop—Immediately following the final snub of the Rating Test, accelerate to 20 mph and make a stop at sufficient deceleration to meet the Hot Stop distance requirement. The maximum service line pressure used shall not exceed 108 psi for vehicles with air brakes or 1800 psi for vehicles with hydraulic brakes.

6.2.6 COOLED STOP—Cool the brakes to 200 F maximum (hottest brake) and make a stop from 20 mph without skid at a deceleration of 9-12 fpsps to determine final braking stability.

6.2.7 FINAL INSPECTION—Remove drums and visually inspect brakes for functional and structural integrity.

6.3 Rating Requirements—In order to complete the Rating Test satisfactorily, the vehicle brake system must comply with the following:

6.3.1 Cold Stop of no more than:

- (a) 25 ft if single-unit vehicle 10,000 lb gvw or less.
- (b) 35 ft if single-unit vehicle over 10,000 lb gvw.
- (c) 40 ft if combination vehicle.

6.3.2 Deceleration of not less than 9 fpsps during the Rating Test.

6.3.3 Hot Stop of no more than:

- (a) 30 ft if single-unit vehicle 10,000 lb gvw or less.
- (b) 42 ft if single-unit vehicle over 10,000 lb gvw.
- (c) 48 ft if combination vehicle.

6.3.4 Stability such as to remain in a 12 ft lane during any brake application throughout all phases of the test procedure.

6.3.5 Final Inspection showing no visual evidence of permanent deficiency in functional or structural integrity of the parts.

6.4 Horsepower Rating Calculation—The horsepower rating of the brake system formula is:

$$\text{Brake Rating HP} = \frac{W(V_1^2 - V_2^2)N}{0.465 \times 2 \times 32.2 \times 550 \times 720} \left[1 - \frac{T_1}{T_2} \right] \quad (1)$$

$$\text{BRHP} = 8.43 \times 10^{-8} \times W(V_1^2 - V_2^2)N \left[1 - \frac{T_1}{T_2} \right] \quad (2)$$

where:

W=gvw of the vehicle, lb

V₁=standard velocity (initial), mph

V₂=standard velocity (final), mph

N=number of snubs made in 720 sec

T₁=calculated time (sec) that the brakes are applied in a single

snub at the velocity and deceleration employed in the test or $T_1 = \frac{(V_1 - V_2)}{d}$. (Substitute V₃ for V₁ and/or d₁ for d

per paragraph 7.2 when running tests with corrected velocity and/or deceleration)

d=standard deceleration for either Burnish or Rating Tests, fpsps

T₂=average drift time (sec) when decelerating from V₁ to V₂ (or V₃ to V₂ when running tests with corrected velocity per paragraph 7.2)

0.465=constant to accommodate velocity in terms of mph in the formula

For the standard procedure (50 to 15 mph snub) Eq. 2 simplifies to:

$$\text{BRHP} = 1.91 \times 10^{-4} \text{WN} \left[1 - \frac{T_1}{T_2} \right] \quad (3)$$

7. Special Procedures

7.1 Formula Snub Ratings

7.1.1 STEPS IN TEST PLANNING

7.1.1.1 Select N from Table 2 (use next larger whole number of snubs).

7.1.1.2 If unable to rate at N snubs but still satisfactory at (N - 1) snubs, it may be possible to rate by change in procedure to obtain only a required minimum BRHP.

7.1.1.3 Selecting final velocity at higher values than 15 mph lends more accuracy in test than changing initial velocity.

7.1.1.4 Let V₄ equal final velocity (mph) to be calculated from minimum required BRHP.

7.1.1.5 From eq. 2:

$$V_4 = \sqrt{V_1^2 - \frac{\text{Min required BRHP}}{(8.43 \times 10^{-8}) \text{WN} \left[1 - \frac{T_1}{T_2} \right]}} \quad (4)$$

7.2 Correction Factors for Burnish and Rating Test—Formulas for correction of test velocity, deceleration, and stopping distance for test leads other than the rated capacity of the axle(s) or vehicle(s) follow:

7.2.1 VELOCITY CORRECTION FORMULA

(a) For vehicles using gvw ratings (for example, trucks):

$$V_3 = \sqrt{\frac{Y}{100} \times (V_1^2 - V_2^2) \times \frac{W}{W_2} + V_2^2} \quad (5)$$

(b) For vehicles using axle rating (for example, semi-trailers):

$$V_3 = \sqrt{(V_1^2 - V_2^2) \times \frac{W_1}{W_2} + V_2^2} \quad (6)$$

TABLE 2—NUMBER OF SNUBS FOR RATING TEST

gvw, lb		1st	2nd	3rd
Min	Max			
4850	5230	17	19	22
5231	5700	17	19	21
5701	6200	16	18	20
6201	6820	15	17	19
6821	7580	15	16	18
7581	8500	15	16	17
8501	9700	14	15	16
9701	11300	13	14	15
11301	13500	12	13	14
13501	15500	11	12	13
15501	20200	10	11	12
20201	29000	9	10	11
29001	52000	8	9	10

TABLE 3—BRAKE APPLY TIME SCHEDULE FOR VARIOUS TOTAL NUMBER OF RATING TEST BRAKE SNUBS^a

Snub No.	Total Number of Brake Snubs (Cycle Time, sec)														
	8 (90)	9 (80)	10 (72)	11 (65.5)	12 (60)	13 (55.5)	14 (51.5)	15 (48)	16 (45)	17 (42.4)	18 (40)	19 (37.9)	20 (36)	21 (34.3)	22 (32.7)
1	1-25	1-15	1-07	1-0.5	0-55	0-50.5	0-46.5	0-43	0-40	0-37.4	0-35	0-32.9	0-31	0-29.3	0-27.7
2	2-55	2-35	2-19	2-06	1-55	1-46	1-38	1-31	1-25	1-19.7	1-15	1-10.8	1-07	1-03.6	1-0.4
3	4-25	3-55	3-31	3-11.5	2-55	2-41.5	2-29.5	2-19	2-10	2-2.0	1-55	1-48.6	1-43	1-37.9	1-33.2
4	5-55	5-15	4-43	4-17	3-55	3-37	3-21	3-07	2-55	2-45.4	2-35	2-26.5	2-19	2-12.1	2-05.9
5	7-25	6-35	5-55	5-22.5	4-55	4-32.5	4-12.5	3-55	3-40	3-26.8	3-15	3-04.4	2-55	2-46.4	2-38.6
6	8-55	7-55	7-07	6-28	5-55	5-28	5-04	4-43	4-25	4-09.1	3-55	3-42.3	3-31	3-20.7	3-11.3
7	10-25	9-15	8-19	7-33.5	6-55	6-23.5	5-55.5	5-31	5-10	4-51.5	4-35	4-20.2	4-07	3-55.0	3-44.0
8	11-55	10-35	9-31	8-39	7-55	7-19	6-47	6-19	5-55	5-33.8	5-15	4-58.0	4-43	4-29.3	4-16.8
9		11-55	10-43	9-44.5	8-55	8-14.5	7-38.5	7-07	6-40	6-16.2	5-55	5-35.9	5-19	5-03.6	4-49.5
10			11-55	10-50	9-55	9-10	8-30	7-55	7-25	6-58.5	6-35	6-13.8	5-55	5-37.9	5-22.2
11				11-55.5	10-55	10-05.5	9-21.5	8-43	8-10	7-40.9	7-15	6-51.7	6-31	6-12.1	5-54.9
12					11-55	11-01	10-13	9-31	8-55	8-23.2	7-55	7-29.6	7-07	6-46.4	6-27.6
13						11-56.5	11-04.5	10-19	9-40	9-05.6	8-35	8-07.5	7-43	7-20.7	7-0.4
14							11-56	11-07	10-25	9-47.9	9-15	8-45.4	8-19	7-55.0	7-33.1
15								11-55	11-10	10-30.3	9-55	9-23.3	8-55	8-29.3	8-05.8
16									11-55	11-12.6	10-35	10-11	9-31	9-03.6	8-38.5
17										11-55	11-15	10-39.0	10-07	9-37.8	9-11.2
18											11-55	11-16.9	10-43	10-12.1	9-44.0
19												11-54.8	11-19	10-46.4	10-16.7
20													11-55	11-20.7	10-49.4
21														11-55.0	11-22.1
22															11-54.8

^a Brake apply time is shown as minutes-seconds elapsed. Time interval includes 5 sec to allow for brake-on-time.

DATA SHEET - BRAKE BALANCE TEST

VEHICLE (circle one): TRUCK TRACTOR-TRAILER

TRUCK OR TRACTOR TRAILER

MAKE _____ MAKE _____

MODEL _____ MODEL _____

		WEIGHT, LB	
VEHICLE	AXLE	VEHICLE RATING	TEST WEIGHT
TRUCK OR TRACTOR	FRONT		
	REAR(S)		
	TOTAL		
	AXLE(S)		

TRUCK OR TRACTOR				TRAILER			
L/F	R/F	LR/F	RR/F	LR/R	RR/R	LR/F	RR/F

1. TEMPERATURE CONDITIONING (TEMPERATURES PRIOR TO INITIAL TESTS)

2. ALL BRAKES (20 TO 10 MPH AT 9-1/2 FPSPS 1/4 MILE INTERVALS BETWEEN SNUBS)

LINE PRESSURE		DECCELERATION	
SNUB 1	PSI		FPSPS
SNUB 2	PSI		FPSPS
SNUB 3	PSI		FPSPS
AVERAGE LINE PRESSURE		PSI	
AVERAGE DECCELERATION		FPSPS	

3. FRONT BRAKES (TRUCK) OR ALL TRACTOR BRAKES (20 TO 10 MPH AT AVERAGE LINE PRESSURE OBTAINED UNDER ITEM 2. 1/4 MILE INTERVALS BETWEEN SNUBS)

SNUB 1	FPSPS
SNUB 2	FPSPS
SNUB 3	FPSPS
AVERAGE	FPSPS

4. REAR BRAKES (TRUCK) OR ALL TRAILER BRAKES (RUN SAME AS ITEM 3 ABOVE)

SNUB 1	FPSPS
SNUB 2	FPSPS
SNUB 3	FPSPS
AVERAGE	FPSPS

5. DRIFT TIME MEASUREMENT (TWO REQUIRED; 20 TO 10 MPH IN DIRECTION(S) DECCELERATION DATA WAS OBTAINED)

DRIFT DECCELERATION = $\frac{2(20.3 - 14.65)}{(T_1 + T_2)}$ = _____ FPSPS

6. BRAKING PERCENTAGE (NUMERALS INDICATE AVERAGE DECCELERATION VALUES FROM CORRESPONDING ENTRIES ABOVE).

DEFINITIONS OF ABBREVIATIONS IN PARAGRAPH 7.3.

TRUCK FRONT AXLE (Y_a) OR TRACTOR (Y_v) = $\frac{(2 - 4)}{(2 - 5)} \times 100 = \text{_____} \%$

TRUCK REAR AXLE (Y_a) OR TRAILER (Y_v) = $\frac{(2 - 3)}{(2 - 5)} \times 100 = \text{_____} \%$

FIG. 4—DATA SHEET—BRAKE BALANCE TEST

TABLE 4

Typical Tests	Rating Test Series				
	1	2	3	4	5
A	1	2	3 passed	4 passed	5 passed (use for rating)
B	1	2	3 passed	4 passed (use for rating)	5 did not pass
C	1	2	3 passed	4 did not pass	4 passed (use for rating)
D	1	2	3 passed (use for rating)	4 did not pass	4 did not pass
E	1	2	3 did not pass	4 did not pass	3 ^a passed (use for rating)

^a Indicates Formula Snub Rating, paragraph 7.1.

7.2.2 DECELERATION CORRECTION FORMULA

(a) Trucks, truck-tractors, full trailers:

$$d_1 = \frac{Y}{100} \times \frac{(V_1 \times d)}{V_3} \times \frac{W}{W_2} \quad (7)$$

(b) Semi-trailers:

$$d_1 = \frac{(V_1 \times d)}{V_3} \times \frac{W_1}{W_2} \quad (8)$$

7.2.3 CORRECTED STOPPING DISTANCE

(a) For vehicles using gvw rating (for example, trucks):

$$S_1 = \frac{100}{Y} \times \frac{W_2}{W} S \quad (9)$$

(b) For vehicles using axle ratings (for example, semi-trailers):

$$S_1 = \frac{W_2}{W_1} S \quad (10)$$

where:

W = gvw of the vehicle, lb

W₁ = load of the test axle (s), lbW₂ = total weight being retarded by the brakes on the test axle(s), lb

Y = braking percentage on the test axle (s) or vehicle (s) (from Brake Balance Test)

V₁ = standard velocity (initial) from which retardation starts when operating at rated gvw for either Burnish or Rating Tests, mphV₂ = standard velocity (final) at which the brakes are released, mphV₃ = corrected velocity (initial) from which deceleration starts operating at other than rated load, mph

d = standard deceleration for either Burnish or Rating Tests, fpsps

d₁ = corrected deceleration, fpsps

S = maximum standard stopping distance, ft

S₁ = maximum corrected stopping distance, ft

7.3 Combining Ratings—The standard procedure will require modification when evaluating brakes on individual axles on a single vehicle or separate vehicles in combination. Whenever possible, a tractor shall be loaded to its gvw and tested as a truck in accordance with the standard procedure. When rating the trailer brakes, the total weight of the combination is made as nearly equal as practicable to the axle rating of the trailer. However, sufficient weight must be on the axle (s) on which brakes are being tested to prevent wheel slippage.

When testing the brakes on individual axles of a single vehicle, the total weight of the vehicle shall be as close as possible to the rating of the front axle when testing brakes on a front axle, but should be loaded to the gvw when testing brakes on the rear axle (s). Whenever the total test weight differs from that desired for the rating of the brakes being tested, apply corrections in initial velocity, deceleration, and stopping distance in accordance with paragraph 7.2.

Combining individual axle or vehicle ratings to arrive at a total rating is a function of brake balance and the brake rating(s) of the axle (s) or vehicle (s).

The Brake Rating Horsepower of a single vehicle is the lowest value obtained by substituting test values from each individual axle in the formula:

$$\frac{100R_a}{Y_a}$$

Similarly, on a combination vehicle:

$$\frac{100R_v}{Y_v}$$

where:

R_a = BRHP obtained on the test axle¹Y_a = braking percentage on the test axle¹R_v = BRHP obtained on the test vehicle¹Y_v = braking percentage of the combination vehicle brakes on the test vehicle²

7.4 Brake Balance Test—This test must be conducted after burnish (paragraph 5.5) and prior to the start of the Rating Procedure (paragraph 6) when axle by axle or vehicle by vehicle ratings are to be combined in accordance with paragraph 7.3. In addition, this procedure may be used optionally at the same point in the overall test to provide useful information concerning the distribution of total braking effort among the axles and/or vehicles in the unit being tested. Such information can be of great use in adjusting brake actuator sizes to achieve a desired proportioning of braking effort among the axles and/or vehicles, but no changes in the brake system may be made at this point to improve brake balance unless new linings are installed and burnished before going on with the Rating Procedure.

7.4.1 STRAIGHT TRUCKS

7.4.1.1 Test Procedure

¹ From Brake Rating Test Data Sheet (Fig. 2).² From Brake Balance Test Data Sheet (Fig. 4).