WEAVER

WY-400 Brake Tester

Brake Manual

How the Weaver Brake Tester Works

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HOW THE WEAVER BRAKE TESTER WORKS

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The wheel plates of the Weaver Brake Tester are in effect simply four horizontal scales, each one of which measures the braking energy exerted by the brake lining against the drum and transferred through the wheel and tire to the roadway. It is important to note right at the start that it is the pounds of brake energy per wheel that is measured. It doesn't matter whether you are stopping from a speed of 5 miles per hour or 90 miles per hour, the same brake energy will give the same rate of stopping. The only difference is that from 90 m.p.h. it just takes longer to come to a stop.

For this reason, it doesn't matter at what speed the car is driven on the Tester, just so it is sufficient to permit desired pedal pressure before the car comes to a stop. A speed of 5 to 10 miles an hour is recommended, though any speed over 5 m.p.h. will give satisfactory readings.

With a light pedal pressure, it takes longer to stop the car, because less brake energy is applied to each wheel. The rate of deceleration is slower and the red liquid will not rise so high in the brake tester tubes.

With a medium pedal pressure, the liquid will rise somewhat higher in the tubes; this test duplicates the average stop in traffic.

To measure brake action in an emergency stop, it is only necessary to apply a full or heavy pedal pressure. (All the pressure that can be used without sliding any wheel.) Regardless of whether the original speed was 5 m.p.h. the tube readings will be the same, since the rate of stopping is the same. This emergency stop gives the full brake energy reading, and by an easy calculation you can tell the minimum distance in which the car can be stopped from any rate of speed.

With the Weaver Brake Tester you actually measure the brake energy applied to each wheel during an actual stop of the car. In arresting this momentum, certain principles of dynamics are involved which cannot be measured with any other type of brake tester. The most important of these is known as the "Transfer of Weight".

When the brakes are applied to arrest momentum, part of the weight of the car is transferred from the rear to the front wheels.

The amount of weight transferred depends on the height of the center of gravity and the length of the wheel base. On most cars making a quick stop, about one-third of the total car weight will be thus transferred.

For illustration, suppose the car weighs 3,000 lbs. with the weight equally divided between the wheels. At rest the front wheels would carry 1,500 lbs. and the rear wheels 1,500 lbs. But during a maximum stop, one-third of the weight carried by the rear wheels - or 500 lbs., would be transferred from the rear to the front wheels; which would make the front wheels carry 2,000 lbs. and the rear wheels only 1,000. By the same token the front brakes can exert twice as much brake energy as the rear brakes and still lock or slide at the same time.

This transfer is in proportion to the rate of deceleration - more on a sudden stop and less when the stop is gradual. For this reason, a sudden stop may show front and rear brakes nearly equal. In equalization tests therefore, the front brakes are compared only with each other - not with the rear brakes.

With these facts in mind, it becomes obvious that there is only one accurate, safe way to test brakes - with a dynamic test made by actually stopping the moving car by a normal use of the brake pedal just the same as you do on the highway. This is just what you do with the Weaver Brake Tester.

Another advantage of this dynamic test is the fact that the action of the brakes is measured and recorded during the ACTUAL PHYSICAL MOVEMENT of the brake pedal. Delayed brake action, due to partly plugged or kinked lines, is discovered by this test as it never can be when the pedal is depressed with a mechanical pedal depressor and held in one position.

Do not overlook the importance of the tread plates with their special mesh surface. Exhaustive engineering tests with these plates have demonstrated conclusively that these plates offer better friction for stopping than a concrete pavement. This means you are measuring every bit of the brake energy the car has.

STANDARDS OF BRAKE EFFICIENCY

Total brake energy (as recorded from a maximum stop) must be compared with the weight of the car to determine brake efficiency. The heavier the car, the more brake effort is necessary to arrest its momentum.

Evenly adjusted brakes with a total energy equal to 80% of the car weight are considered EXCELLENT, and will bring the car to a full stop in 37.5 feet from 30 miles an hour, or ordinary city driving speed. These we call 80% brakes.

70% brakes (properly equalized) are GOOD: 60% brakes are FAIR. Brakes having total energy LESS THAN 50% of passenger car weight are DANGEROUS, and cannot be recommended.

The distance required to stop a car is in proportion to the SQUARE of its speed. Double the speed and the car requires four times the stopping distance. The car with 80% brakes which can stop in 37.5 feet from 30 miles an hour will require 150 feet in which to stop from 60 miles an hour. Sell your customer BRAKE ENERGY by pointing out that those extra 50 feet may mean the difference between going into the ditch or avoiding it, between hitting the child or having time for him to get out of the way.

VARIATIONS IN READINGS

We now come to one of the most important features of the Weaver Brake Tester - its ability to measure those peculiarities of brake action which cause the brakes to take hold one time and fail to hold the next, or cause the pedal to "fade" as it is pushed beyond a certain pressure.

Erratic brakes are really quite common, and you may be sure that if they record varying readings on your Weaver Brake Tester, they are acting just as erratically on the road. The important thing after all is that with your Weaver Brake Tester you can discover them, find out which brakes are affected, and quickly locate and correct the cause of the trouble.

While it is not our intention to tell you how to repair, reline and adjust brakes, the Weaver type Brake Tester is the ONLY shop equipment which discovers these conditions (although they are even sometimes noticed on the road) and accordingly most brake manuals only cover the subject in a general way.

Partially plugged or kinked hydraulic lines may so delay the starting action of one or more brakes that they will not have time to properly register on the Brake Tester. Other factors such as sticky wheel cylinder cups, tight anchor pins, etc., may also produce delayed brake action. This is a particularly dangerous condition causing a car under a sudden stop to first "Dive" and then straighten out. (WEAVER BRAKE-O-GRAPH will uncover the slightest delay in the brake action of any wheel, thus permitting correction before the condition becomes dangerous.)

Several successive tests with the same brakes may show a gradual decline in the total brake energy registered. This is due to the generation of heat in the brakes, resulting in a gradual decrease in efficiency. It is an established fact that some linings will offer less friction as they become heated, which accounts in part for "fading".

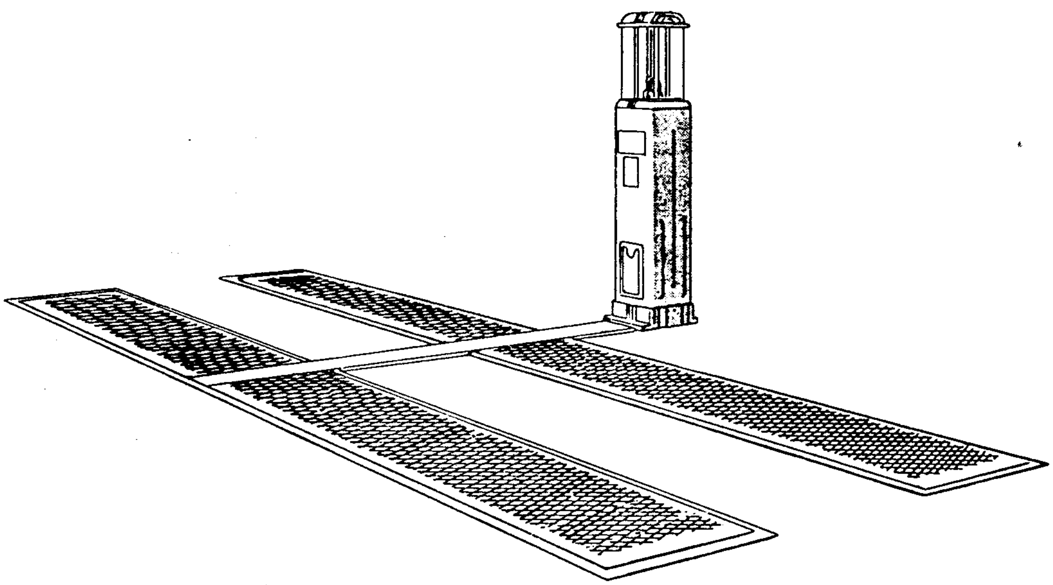
HOW TO TEST YOUR BRAKE TESTER

One other detail which you should know about your Weaver Brake Tester is how to test its accuracy. There are few things that can go wrong with it, especially if you give it the regular attention and service recommended in the instructions which accompanied it. However, especially on older machines, an occasional test for accuracy may be advisable. You will probably want to make it the first time you come across a car with erratic brakes.

First make sure that the red liquid is at the zero mark in the tubes and that the car which you use has rear tires about equally worn and properly inflated. Be sure there is no grease or accumulation of dirt on the Brake Tester plates. Drive the car onto the Brake Tester, stopping with a very gentle pedal pressure when the rear wheels of the car are at the front end of the rear tread plates. (Be sure red liquid is still at zero.) Set your gears in reverse and release the clutch pedal suddenly, backing up three or four feet and stopping with the rear wheels still on the rear Brake Tester tread plate. The car differential has automatically equalized the acceleration pressure applied to the rear wheels, and the red liquid should be approximately even in the two corresponding rear tubes. A slight variation will be of no consequence, but they should equalize within about half an inch. Now drive forward until the rear wheels of the car are on the front end of the front tread plates of the Brake Tester, and back up the same way on these plates. This will give a similar test on the two front plates.

WEAVER

BRAKE MANUAL



WEAVER BRAKE MANUAL

Every vehicle that travels on street or highway has MOMENTUM – a force that is proportionate to weight and speed. Safety to passengers and pedestrians depends in large measure on the ability of the driver to arrest that momentum quickly when danger presents itself and while doing so to retain directional control of that momentum in his steering wheel.

Probably no safety factor of the motor vehicle is so important as its brakes, and probably none can be pointed to as responsible for so large a share of our automobile accidents. Conscientious accurate brake service must be considered more than a casual shop job - it is a humanitarian service that should call forth the most careful and skillful efforts of men specially trained in this work.

It is the purpose of the Manual to supply garagemen with certain fundamental principles of brake mechanics which apply to ALL brakes and which serve as the foundation upon which all motor vehicle brakes are constructed and must be serviced.

For a detailed description of the individual peculiarities of the different makes and types of brakes we refer you to the trade press and the service manuals of the various automobile and brake manufacturers which carry specific descriptions of the many necessary service operations which we shall not attempt to detail in this booklet.

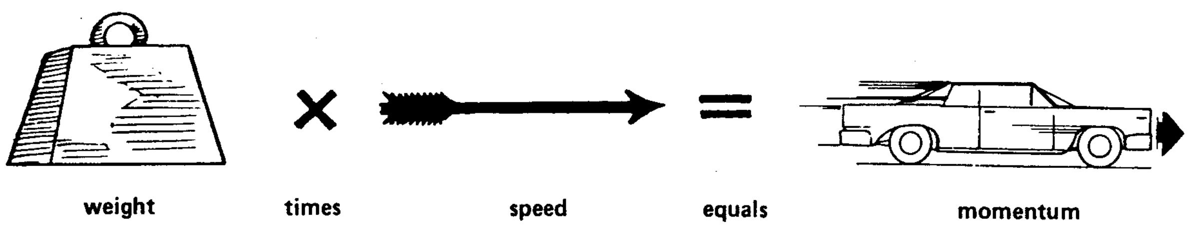
ARRESTING MOMENTUM

What becomes of momentum when the vehicle stops? The momentum energy is converted into heat energy by the friction of the brake shoe on the drum; or if the shoe and drum are locked by too much pressure, by the friction of the tire on the road as the tire skids.

In ordinary driving the brakes are applied intermittently, and the heat generated in the brake drum is dissipated into the air between one brake application and the next. In cases of long-continued braking, such as going down a mountain-side or long steep hill, this heat accumulates faster than it can be dissipated and the brake drum and shoes become excessively hot. Inferior brake linings become slippery (i.e. have reduced coefficient of friction) when hot, and the brakes "fade". (Some of the better grade brake linings actually have increased friction when super-heated.) Or with insufficient pedal reserve, the pedal may go clear to the floor board and still the brakes "fade" because of expansion of the brake drum. Except in such cases of long-continued brake application, however, the air flowing past the brake drum normally carries away the heat fast enough to prevent brakes and drums from becoming overheated.

MOMENTUM – ITS RELATION TO BRAKES

Momentum (which brakes must convert into heat) varies in proportion to the speed and weight of the vehicle (including its load). Mathematically momentum is figured thus:



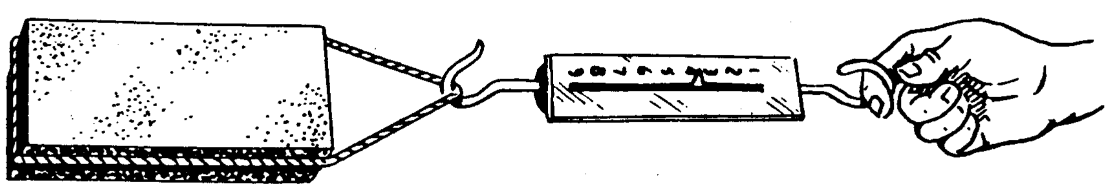
Thus a 6000 lb. vehicle traveling 40 miles per hour has twice as much momentum as it does at 20 m.p.h. and brakes must convert twice as much momentum into heat in order to stop the car – which takes just twice as much time.

THE TIME ELEMENT

Since we are first ot all interested in the time it requires to stop a motor vehicle, let us explore those other factors (besides momentum) which effect the time which must elapse between the moment the brakes are applied and the car comes to a stop. Braking time requires that we take into consideration rate of speed of the vehicle, rate of deceleration, coefficient of friction between tires and road and between brake drum and lining, and various other elements that are variable and hence affect the time factor. Though some of these terms may sound technical, the meanings which they imply are really very simple, and an understanding of them being essential to knowledge of brake effectiveness, we shall discuss them briefly.

COEFFICIENT OF FRICTION

"Coefficient of friction" is the force necessary to drag one body over another, and is expressed in terms of the proportion of the pull applied, to the weight being dragged. For a simple illustration,



take an ordinary building brick and drag it along a cement sidewalk with a spring scale. We find that it requires just 3.5 lbs. pull to move the 5.25 lb. brick. This we say the coefficient of friction of brick on cement is 3.5 ÷ 5.25 or 67%. This same pull (3.5 lbs.) will be found necessary to move the brick whether it lies face down, on edge, or stands on end; the area in contact with the cement makes no difference in coefficient of friction, though it makes a tremendous difference in rapidity of wear. (Hence the importance of correct shoe adjustment, to spread the wear over the largest possible area of lining surface. This also serves to distribute the generation of heat, since heat reduces the friction of most brake linings.)

Coefficient of Friction, then, expresses the amount of pull necessary to cause slippage of one surface over another.

PAVEMENT COEFFICIENTS

When we attempt to arrest the momentum of a car, we are very much interested in the coefficient of friction between the rubber tires and the road. Experiment has shown that the coefficient varies greatly depending on the material of which the road is constructed, and its condition (whether wet or dry). Typical tests of roads show the following coefficients of friction with new tires.

Material	C. of F.
Concrete (2 yrs. old)	74%
Concrete (5 yrs. old)	68%
Bitulithic	67%
Wood Block	79%
Brick (monolithic)	84%
Brick (sand filled)	82%
Brick (asphalt filled)	89%
Gravel	61%
Dirt	52%
Dirt – wet	29%
Cinders	60%
Snow – smooth, hard pack	15%

Thus on an asphalt filled dry brick pavement we can apply brake energy equivalent to 89% of the car weight before we lock the wheels and begin to skid. 89% is the "skid point" on such a road, which is one of the best surfaces we have. Hence it would be futile to put brakes on a car capable of delivering brake energy of more than 89% of the car wieght, since application of them would merely result in skidding the tire on the pavement. This skidding not only burns away the tire tread, but seriously interferes with steering, making it both destructive and dangerous.

The great reduction in coefficient of friction on most surfaces when wet makes it necessary that the driver use caution in applying brakes to avoid skidding in rainy weather. Accordingly the frequent use of highway signs that read: Pavement slippery when wet".

Effective braking consists in applying the greatest possible friction within the brake which is possible without locking the wheels. Most present day brakes are of the expansion or internal shoe type. The necessary friction for braking is attained by the application of the shoe against the drum at high pressure – this pressure having the same effect as weight in the creation of friction.

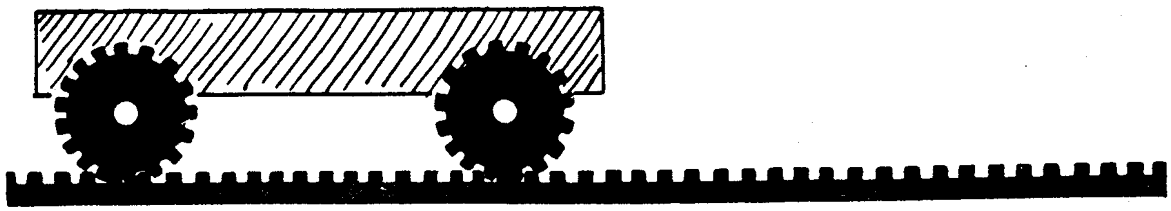
When brake shoes are out of adjustment and friction takes place at one particular spot, this spot not only wears more rapidly, but it becomes overheated, causing deterioration.

RATE OF DECELERATION

From the definite limits above noted in the coefficient of friction between tires and road surfaces of various kinds, we conclude there is a definite limit to the amount of brake energy that can be successfully applied in stopping the momentum of any vehicle: and that on the best road surface ordinarily available, under the most favorable weather conditions, brake energy of about 90% of the loaded vehicle weight constituted this maximum.

To carry our investigation a bit further along this direction, let us see what effect this coefficient of friction and limit to useful brake energy have on time necessary to arrest momentum.

Imagine if you will a cog-wheeled vehicle on a cogged track such as is shown below, which, of course, would have a better coefficient than our very best pavement.



When our vehicle moves along its track, the application of brake energy equal to the vehicle weight will reduce its speed by exactly 32.2 feet per second (or about 22 miles per hour). That is to say, if the vehicle were traveling 60 miles per hour (88 ft. per second) just before 100% brakes were applied, at the end of one second the vehicle would have a speed of 88 ft. per second minus 32.2 feet per second, or 55.8 feet per second.

The engineer expresses this fact by saying that "the rate of deceleration with 100% brake effort is 32.2 feet per second". This rate of deceleration is exactly the same as the rate of ACCELERATION of a falling body due to the force of gravity.

At the end of the first second our 88 ft. per second speed will have been reduced (as stated above) to 55.8 feet per second. At the end of the 2nd second it will be (55.8 minus 32.2) 23.6 ft. per second; and before the end of the 3rd second it will have stopped.

If instead of brake energy of 100% (or equal to weight of vehicle) we only apply half as much brake energy (50% of vehicle weight) the rate of deceleration is just one half, and the time required to bring the vehicle to a stop is exactly twice as long.

Now when we drop out brake energy to just 50% of the vehicle weight, we no longer need the cogged track, because more than 50% of the vehicle weight is necessary to cause slippage, and the tires will hold just as effectively as the cogs when there is only 50% brake pressure.

COMPUTING BRAKING TIME

For those who are interested in a formula for figuring the time required to stop a given vehicle, the following will be of interest:

Braking time (in seconds) = speed (in miles per hour) ÷ 22 x % brake energy.

For example, with 70% brake energy on a car going 45 miles an hour the braking time would be:

45 ÷ 22 x 70% or 45 ÷ 15.4 or slightly less than 3 seconds.

BRAKING DISTANCE

Braking distance is for practical purposes more valuable to know than braking time, for although braking time is in direct proportion to the original speed, braking distance is in proportion to the square of the speed. That is to say, a car traveling 40 miles an hour will require 4 times the braking distance that it will to stop from 20 miles an hour; and from 60 miles an hour it requires 9 times the braking distance necessary from 20 miles an hour. A moment's reflection will show that this is so.

The following table illustrates this fact; The car is assumed to have 50% brakes. Note that when original speed was 30 miles an hour, it travels only 1/4 the distance required from 60 miles an hour; and from 20 miles an hour only 1/9 the distance.

Original Speed	60 mi. per hr. or 88 ft. per sec.	30 mi. per hr. or 44 ft. per sec.	20 mi. per hr. or 29.3 ft. per sec.
Distance traveled during 1st second after brakes are applied	79.96 ft.	35.95 ft.	21.25 ft.
during 2nd second	63.85 ft.	19.85 ft.	6.60 ft.
during 3rd second	47.75 ft.	5.90 ft.	---
during 4th second	31.65 ft.	---	---
during 5th second	15.55 ft.	---	---
during 6th second	3.75 ft.	---	---
Traveled before stopping	242.50 ft.	61.70 ft.	27.85 ft.

COMPUTING BRAKING DISTANCE

For those who wish a formula with which to calculate braking distance in feet from a given speed and with brake power of a known amount, the following will be of interest:

Braking distance (in feet) = speed x speed (in miles per hr.) ÷ % brake Energy x 30.

For example with 75% brake energy on a car traveling 40 miles an hour, the braking distance (in feet) would be:

40 x 40 ÷ 75% x 30 or 1600 ÷ 22.5 or 71.11 feet.

THE "SKID" POINT

Suppose our car has brakes capable of exerting brake energy of 70% of the car weight, but the car were traveling over smooth, hard-packed snow with a coefficient of friction of only 15% (see table Page 3). The amount our 70% brake effort is applied the tires skid, and the coefficient of friction must take the place of brake energy in our formula. If the car were going 40 miles an hour over the snow covered road, its minimum braking distance (or forward skidding distance) would be:

$40 \times 40 \div 15\% \times 30 = 355.55$ feet

Thus in figuring stopping distance, we must always use the % brake energy OR the coefficient of friction of the road, whichever is the LESSER.

BRAKE EQUALIZATION

Thus far we have assumed that our motor vehicle had all brakes equally adjusted, and that on the 4000 lb. car (for example) each brake exerted the same retarding force, or 750 lbs. Four brakes with 750 lbs. of brake effort each would total (4 x 750) 3000 lbs.

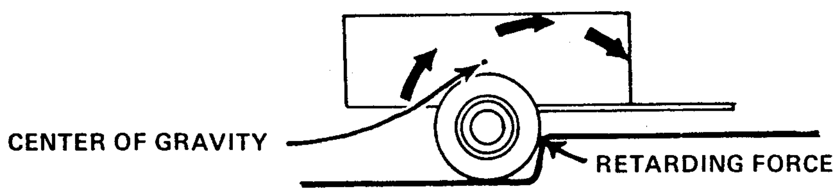
But suppose now that the car brakes are not equally adjusted (a few of them are) and that one brake has been so tightened it applied much greater pressure than the others. In applying pedal pressure that brake may easily lock and cause its wheel to skid.

For the present, then, we will assume that equal pressure should be supplied on each of the four brakes. Other considerations must be taken into account which we will next discuss, that show why such equalization does not necessarily give us equalized brakes.

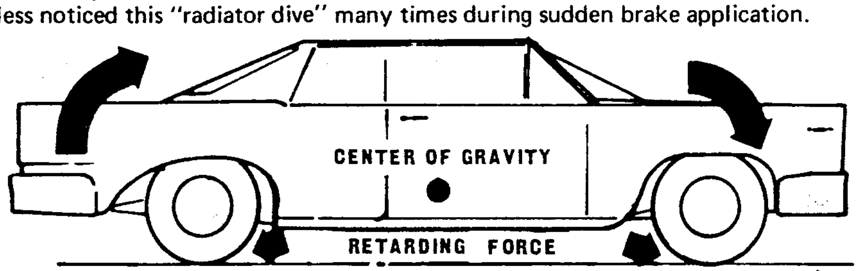
TRANSFER OF WEIGHT

To more fully understand the action of motor vehicle brakes, we must now consider for a moment the forces (or dynamics) that take place within the car while its momentum is being arrested. Although our brake force is APPLIED at the brake drum, its EFFECT in slowing down the car takes place at the point of contact of the tire on the road. That is to say, it is the rubber holding to the pavement that actually slows down the motion of the vehicle. That is why more brake power than the coefficient of friction between tire and road results in a skid.

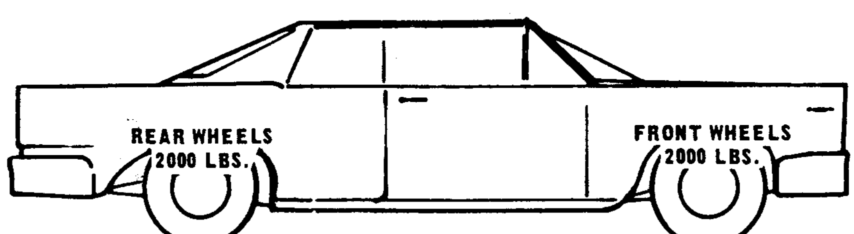
When brakes are applied, therefore, the resulting forces can best be understood if we imagine a two-wheeled trailer striking a curb;



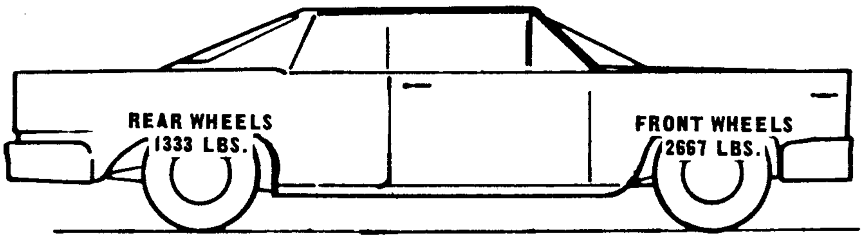
The center of gravity, being on a different level from the point at which the retarding force is applied, tends to pivot around that point; so that the rear end goes up and the front end goes down. In a motor vehicle the same forces are present. The retarding force is applied at the point of road contact of the tires and the rear end of the car tends to go up and the radiator down. You have doubtless noticed this "radiator dive" many times during sudden brake application.



Naturally when weight is thus lifted off the rear wheels, and added to the front wheels, the front brakes must stop a larger share of the total car weight. The amount of wiehgt thus transferred from rear wheels to front depends on the height and position of the center of gravity, and on the rate of deceleration. In a given car, the position of the center of gravity being constant, the amount of weight transfer depends entirely on the rate of deceleration. The quicker the stop, the more weight is transferred. On a very gradual stop the transfer of weight is so small as to be negligible for practical consideration. On a sudden stop it frequently amounts to as much as one sixth or more of the total car weight. Thus on a free rolling car, weighting 4000 lbs., assuming the weight to be evenly distributed, weight carried by the wheels would be:



The same car on a quick stop shows one sixth of total car weight (667 lbs.) transferred from the rear to the front wheels, so that the weight carried would be:



Now if you will refer back to our 4000 lb. car with four equal brakes applying 750 lbs. pressure each, you will see that when it makes a quick stop with full brake power applied, we are using 1500 lbs. of effort on the rear wheels to stop 1333 lbs. of weight, or a brake energy of 112.5% – more than enough to skid the rear wheels on the best pavement we know. On the front wheels we have the same brake energy used to stop 2667 lbs. or a brake energy of about 56% – just half as much.

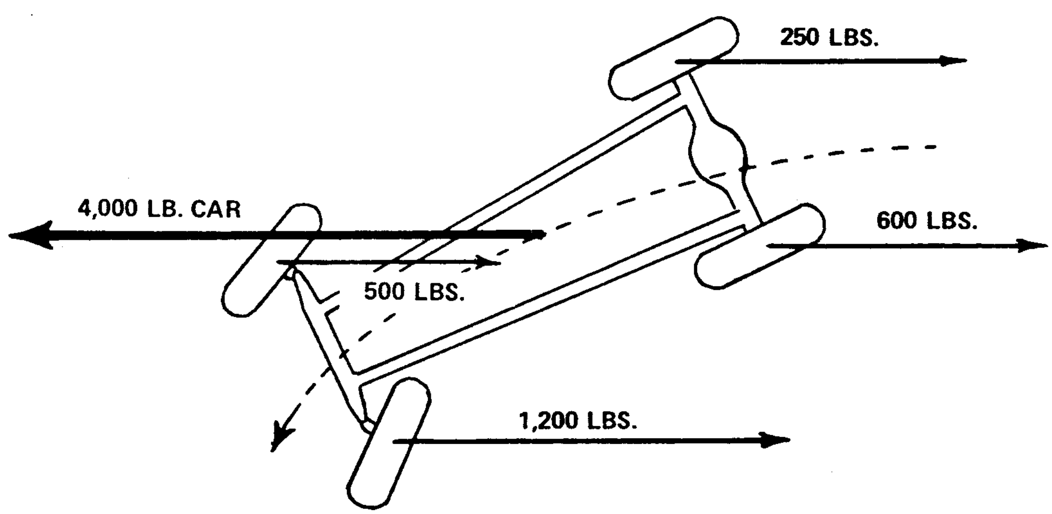
This is why some manufacturers have placed 60% of their total brake effort on front wheels and 40% on the rear wheels. Others, desiring to avoid any danger of skidding front wheels (and loss of steering control) have thought best to place 60% of the total brake effort on the rear wheels. Still others supply equal brakes all around. Each theory has its proponents, and much is to be said in favor of each method of brake division. After all, OUR problem is to service brakes, not to build them; and this information is merely given to assist brake mechanics to a better understanding of the principles of effective motor vehicle braking. The important thing is to understand WHY a sudden stop on a Weaver Brake Tester shows more transfer of weight than does a gradual stop.

SIDE PULL AND SKIDDING

Our thoughts of skidding have thus far been concerning a forward slippage of the tire along the road. All drivers know that this is usually much less dangerous than a skid sideways. Most often side pull and sideways skidding are the result of unequal brake effort applied on the two sides of the car.

For example suppose the right front brake had a greasy lining, greatly reducing its friction and correspondingly weakening brake effort on that wheel; then when brakes are applied the left front wheel tends to hold back much more than the right, and the vehicle veers to the left. When it is the front brakes that are unequal, the car pulls toward the side with better brakes. When the rear brakes are unequal, the rear end of the car slips toward the side with the weak brake because the good brake tends to drag behind the load.

Sometimes a car will be found with higher brake energy on the same side both front and rear. Then we find a series of forces operating as in the following diagram.



The desired direction of travel is shown by the large arrow. Excessive brake energy on the left front wheel tends to pull the front end of the car to the left, while excessive brake energy on the left rear wheel tends to make the rear end slip to the right, still further aggravating the twisting motion or skid of the car.

Good brakes demand the elimination of all such side pull and skidding so that brake application will not interfere with steering control.

THE BRAKE LINKAGE

When pressure is applied on the brake pedal, the force applied by foot power is carried to each of the four brakes, in order to bring pressure of the brake shoe against the drum, there to create friction and arrest the vehicle's momentum.

It should be sufficient to say that in the case of hydraulic brakes, the mechanic must use care to see that the hydraulic lines are unobstructed (either by kinks or by being air-bound) and that there is ample reserve of fluid in the supply tank. Also that there is no leakage at the master cylinder, in the lines, or at the wheel cylinders. In such circumstances the hydraulic linkage can be depended upon to deliver equalized pressure at the four wheel cylinders.

THE BRAKE MECHANISM

Within the brake drum is the brake mechanism, which actually applies the shoe against the drum. Once the foot pressure is delivered to the brake shoe, ALL brakes become mechanical! That is to say, the service problems that center around the brake mechanism – the shoes, the lining, pins, anchors, etc. – are strictly mechanical. Anchors may freeze, lining become worn or greasy, dust (from friction) may accumulate within the drum.

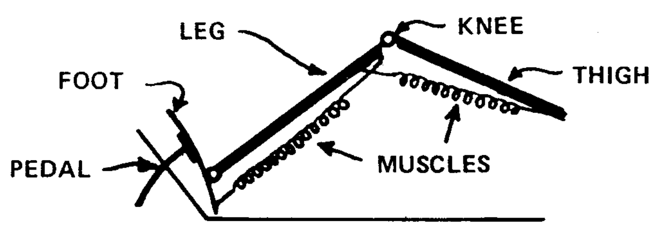
Since these represent a considerable share of brake service, drivers should be educated to the necessity of frequent brake inspections, regardless what type of brakes they may have.

PEDAL RESERVE

The brakes should be fully applied when the pedal is about half way to the floor. The reason for this is that continued brake application generates heat, causes the drum to expand, and hence the pedal must move still further to maintain brake application at the desired pressure. If there is pedal reserve, this additional movement is possible; but if the first brake application carries the pedal to the floor board, then continued braking causes the drum to expand away from the shoe, and the brake power will "fade".

BRAKE APPLICATION

In actual practice, brakes are applied by pressure of the driver's foot on the brake pedal. The muscles that are used for exerting this pressure are those from the thigh to the foot. Diagramatically they might be indicated thus:



Without any more intimate study of human anatomy you can realize what a flexible system of "hinges" and "levers" the human leg is, as it applies pressure on the brake pedal. The "springs" or muscles being both elastic and responsive, will maintain fairly even pressure even though there is some fluctuation of the pedal.

Any fair test of brake effectiveness should therefore be taken not only during the actual stop of the car, but with pressure applied naturally with the foot. Use of a pedal jack must of necessity show artificial results in proportion to its own artificiality as a means of applying pedal pressure.

REACTION TIME

Another important consideration with regard to the human factor in brake application is the reaction time or thinking time necessary for the driver to apply brakes after it becomes apparent that it is necessary for him to do so. This will vary from a fraction of a second to as much as 2 seconds for some drivers, depending on age, natural mental alertness, fatigue, alchoholism, etc. For the average driver not unduly fatigued this will be about 3/4 of a second.

Not much time, to be sure; but translated into terms of distance traveled it becomes extremely important, especially at modern high speeds. For example at 60 miles per hour a car would travel 66 feet during that 3/4 second of reaction time; and that must be added to the braking distance in order to figure the actual time and distance in which a driver can stop his car. For the car with 50% brakes traveling 60 miles an hour, this would be:

STOPPING TIME	STOPPING DISTANCE
.75 seconds – FOR THINKING	66 feet
5.45 seconds – FOR BRAKING	240 feet
6.20 seconds – TOTAL	360 feet

DELAYED BRAKES

Added to the human delay in brake application, there is sometimes a mechanical delay in the transmission of power from the foot pedal to the brakes. Rusty or frozen brake linkage will cause this, as will a kink or obstruction in the hydraulic tube. Having seen above what even a fraction of a second delay means in distance traveled by the vehicle, the time element in brake application looms larger and larger as a safety factor.

HOW TO READ YOUR WEAVER BRAKE TESTER

Two sets of calibrations appear on each of the four tubes in the glass-inclosed Brake Tester Pedestal. The red calibrations are for use in determining brake equalization, each red mark being just 20% lower than the one above. A maximum of 20% variation between the two front brakes will give satisfactory braking from a practical standpoint. More than this is beyond the recommended range of "allowable tolerance". Similarly not over 20% variation should be permitted between the two rear brakes.

When the car stops on the Weaver Brake Tester, you will notice that the front brakes register considerably more brake energy than the rear brakes, due to the Transfer of Weight. The more suddenly the car is stopped, the greater will be the weight transfer, and the greater will be the work falling on the front brakes. Hence on a quick stop the front brakes will register proportionately higher than on a gradual stop.

The question frequently arises among new users of the Brake Tester as to the effect that vehicle speed has on the Brake Tester readings.

If you were driving on the highway at 20 miles an hour and applied brakes suddenly, you would be able to stop within a given distance. From 40 miles an hour you would require a considerable greater distance with identically the same car, the same brakes, and the same pedal pressure. The rate of deceleration would be the same – but from the higher speed there would be greater momentum to overcome, which naturally takes longer.

The Weaver Brake Tester, being in effect merely four horizontal scales, measures that rate of deceleration. The speed of the vehicle makes no difference just so it is sufficient to overcome the inertia of the machine, for which reason we recommend a speed of about 4 miles an hour.

Sudden application of the brakes from a speed of 4 miles an hour will show identically the same readings as if the car were stopped from 50 miles an hour. The ordinary driver does not apply his brakes suddenly from 4 miles an hour (because it is not necessary in ordinary driving though he will from a somewhat higher speed). Hence recommend about 4 to 8 miles per hour speed (not more) to your customers when they use the Tester themselves.

The second set of calibrations on the Tester tubes show brake energy for each brake in hundreds of pounds. Add the readings for all four brakes together to secure the total amount of Brake energy which the car has; and then divide the total by the weight of the car to find out the % Brake Energy. For example, suppose brake tubes showed readings as follows:

Left Front Wheel	1100 lbs.
Right Front Wheel	1000 lbs.
Left Rear Wheel	800 lbs.
Right Rear Wheel	850 lbs.
*Total brake energy	3750 lbs.*

*The 5th tube is the totalizing tube and shows total effort, eliminating the need for adding the individual scale readings.

If these brakes are registered on a heavy car, the weight of the car would be about 5000 lbs. Dividing amount of brake energy by car weight (3700 – 5000) gives us 75% brakes, which are considered GOOD. From the formulas previously given, it is now possible to figure stopping time and stopping distance for this car from any given rate of speed.

WEAVER®
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FORM NO 1625

PRINTED IN U.S.A.