Dr. Peter Kyropoulos uses a sound-level meter microphone to measure the heart beat of an automobile engine

TAKE THAT LEAD OUT OF YOUR SHOES

Do you drive with a "heavy foot"? Take it easy, and you'll get more out of your car. Here are some basic rules for economical driving, inspired by the recent Economy Run

by PETER KYROPOULOS

IF YOU CAN AFFORD to drive a car, you cannot afford to pass up the lessons that can be learned from the 1951 Mobilgas Economy Run. The results are tabulated on page 15.

These results, of course, amount to the gospel according to the advertising department. After looking them over, your reaction is sure to be: How come and how can *I* get that?

The answer is intuitively obvious: The Economy Run demonstrates "potential performance." This sounds impressive. What does it mean? What is performance anyway?

Let us look at the 4000 pounds of shiny gadgetry in which you take your life in the remaining left hand (the right arm was lost in the purchase).

What price speed?

The chart on page 12 (#1) shows the power-required of a typical car plotted against speed in mph. The curve is the average for a Ford, Chevy Styline (bustle back), and Fleetline (torpedo back). This is the power you really need for level road cruising. It is called the *road load*.

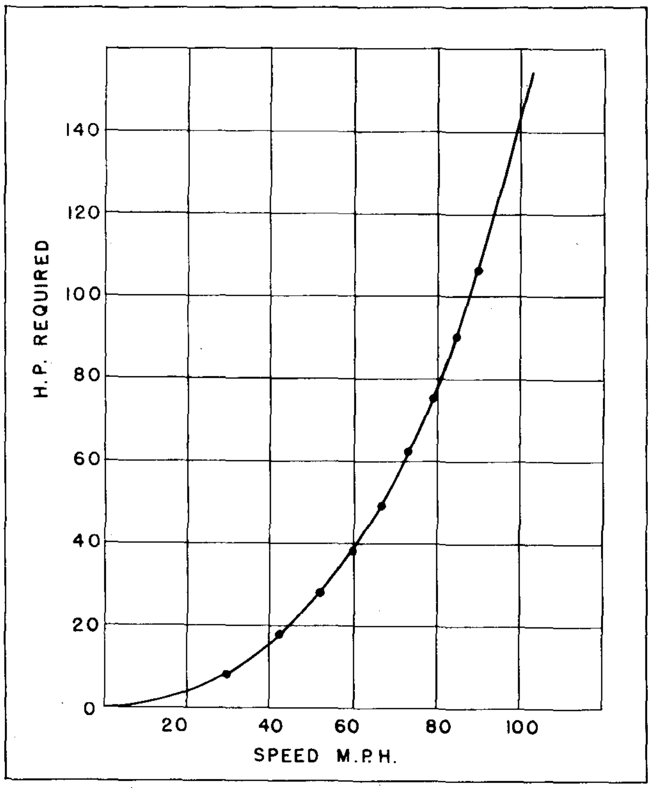


Chart 1

Power-required of a typical car as a function of forward speed (mph). The curve is an average for Ford, Chevrolet Styline and Fleetline. (Reference: Full-Scale Wind Tunnel Tests of 1949 Automobiles by Kenneth Razak, University of Wichita, Bulletin #21, 1950).

Chart 2 shows the power which the engine can furnish (power-available). There are three curves: the highest corresponds to full throttle operation; the two other curves are for part throttle operation. (Part throttle means reduced manifold pressure. A manifold vacuum gauge is a useful tool in determining engine performance, since a change in manifold vacuum indicates a change in power.)

Chart 3 shows the fuel consumption as a function of horsepower at different engine speeds. The road-load is shown as a dashed line. It corresponds to the power required from Chart 1. Transmission is in direct drive (transmission output rpm = engine rpm), whence for a given rear axle ratio there is *one* engine rpm which gives the road power-required. The fuel consumption is given in "pounds of fuel per brake-horsepower per hour" (brake specific fuel consumption). The use of all this is best shown by an example. Let us calculate the level road fuel consumption of our car at 40 mph.

From Chart 1 we find that the power required is 15 hp.

From Chart 3, with 15 hp and on the road load curve, we find the fuel consumption to be 0.65 lbs/bhp-hr.

We are drawing 15 hp, hence we are using 0.65 x 15 = 9.75 lbs of gasoline per hour, or, since there are 6 lbs of gasoline in a gallon, 9.75/6 = 1.625 gallons per hour.

During this hour we are traveling 40 miles (speed was 40 mph). Therefore, the fuel consumption is 40/1.625 = 24.6 mpg. A somewhat hasty road test on my Chevrolet Powerglide, adjusted for the torque converter losses, showed 23.2 mpg, averaged over five runs. These test runs included two stops each. The method used to obtain fuel consumption data is described at the end of this article.

Now we know how this mysterious "potential performance" comes about.

But your brother has a friend who has a neighbor who has a Powerglide which he calls a "gas burner." It gets 12 miles to the gallon. How can this be? Most likely this is exactly what he gets, but I submit that *he* is the gas burner, not the car. Another road test example will illustrate this.

Test conditions: Colorado Street in Pasadena, 11:00 a.m. on a week day.

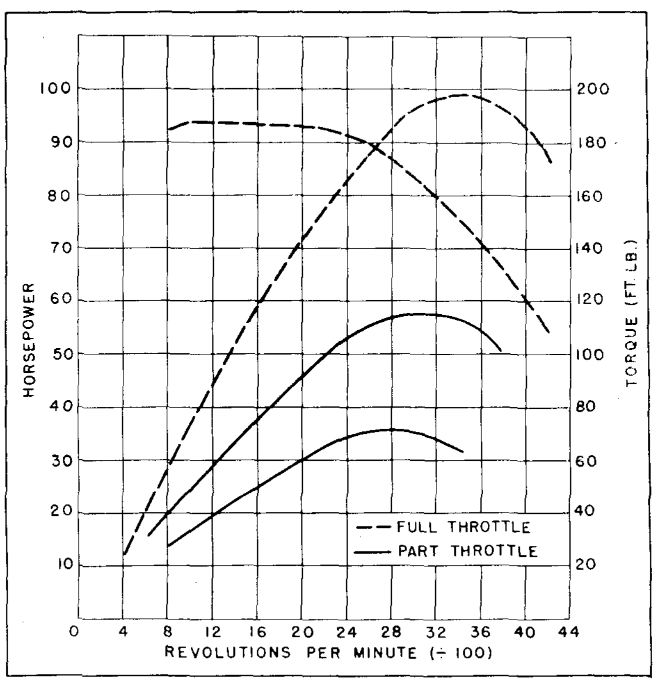


Chart 2

Power-available from a 235-cu.-in. Chevrolet engine. (Reference: Chevrolet 1951 Specifications).

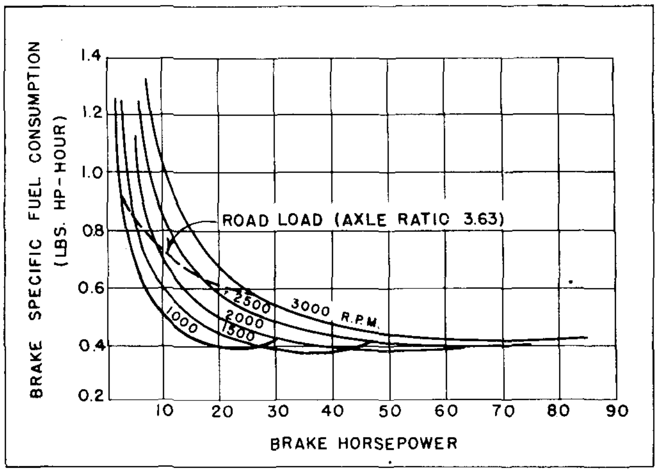


Chart 3

Typical part throttle fuel consumption data. (Reference: High Compression Ratios in Automotive Engines by D. F. Caris and A. D. McDuffie, SAE Reprint, Dec. 8, 1947).

Traffic lights: theoretically synchronized to 25 mph; actually s. n. a. f. u.

Number of stops: too many.

Speed: a patient 25 mph, staying in the same lane, starts in low.

Average mileage: 18.5 mpg.

The same course, driving as fast as space will permit, with quick starts: Average—15 mpg.

This brings out the point that driving habits and traffic conditions determine mileage. Driver training, therefore, is also the reason for the performance during the Economy Run.

The comparison quoted is typical and can be obtained with any car. The Southern California Automobile Club some time ago published tests on a Dodge. The results were as follows:

Downtown L.A. traffic: 8.7 mpg.

Residential street, 5 stops, 25 mph: 14.7 mpg.

Highway, no stops, 25 mph: 22.3 mpg.

Economy with hydraulic transmission

Why do the automatic transmissions, particularly the Dynaflow type, have a reputation for poor mileage? Well, for one thing, they do not have to be nearly as bad as most drivers manage to make them.

Chart 4 shows typical efficiency curves for a transmission like the Dynaflow or Powerglide (called a polyphase torque converter—and what a mouthful. No wonder it costs $169.85 extra). Again we have a marked difference between full throttle and road load performance. Let us say that you are moving along at 10 mph and you really want to show that blonde in the convertible in the next lane that you are not nearly as old and feeble as your looks might indicate—in short, you floor the throttle and take off. The transmission efficiency is 50%. If you draw only road load, the efficiency is 85%. It is easy to see why this sort of thing takes a lot of gasoline.

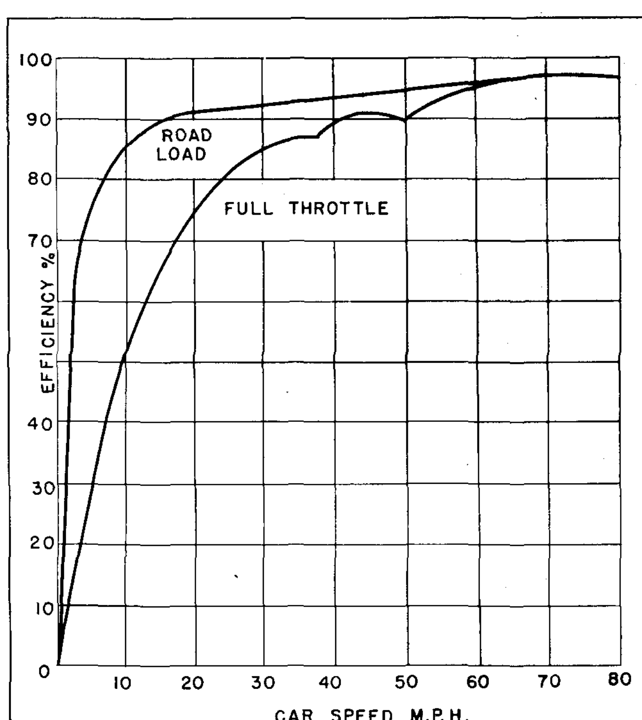
Killjoy was here

It seems, then, that by implication I am acting like the doctor who puts an embargo on drinking, smoking, etc. A man simply can't have fun. Before getting discouraged, let us examine what "having fun driving" really costs.

Suppose that you drive an average family car 10,000 miles per year with a mileage of 20 mpg. You are then buying 500 gallons of gas, at about say 25 cents per gallon, for 125 dollars. If the mileage were improved to 25 mpg, you would save exactly 25 dollars. If you were driving like the proverbial bat out of hell, at 15 mpg, it would cost you 42 dollars more a year (this does not include fenders and other breakage). It might

Chart 4

Typical efficiency curves for a polyphase torque converter—Dynaflow or Powerglide. (Reference: Automatic Transmissions, Part 8, by P. M. Heldt, Automotive Industries, July 1950).



well be suggested that it you cannot afford 42 dollars a year on having some fun, you have no business driving a car anyway. So, speed on big boy; hell ain't half full yet.

This is, of course, a matter of taste and opinion. One may also make a sport of getting good economy and, in that case, here are a few suggestions.

Basic rules for economic driving

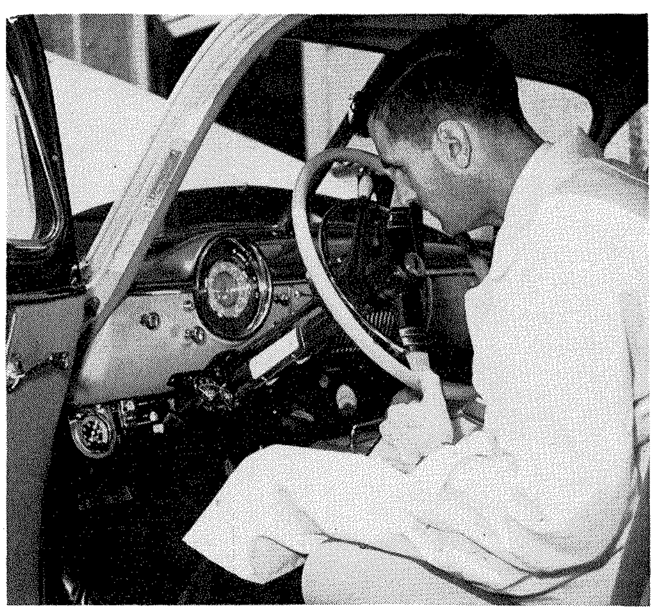
Let's begin in the morning.

(1) Don't jiggle the throttle (accelerator) before starting. Kick it down once for priming. (Each time the throttle is opened, the accelerator pump goes into action. 8 strokes are about equivalent to 1 mile of driving at a consumption of 15 mpg.

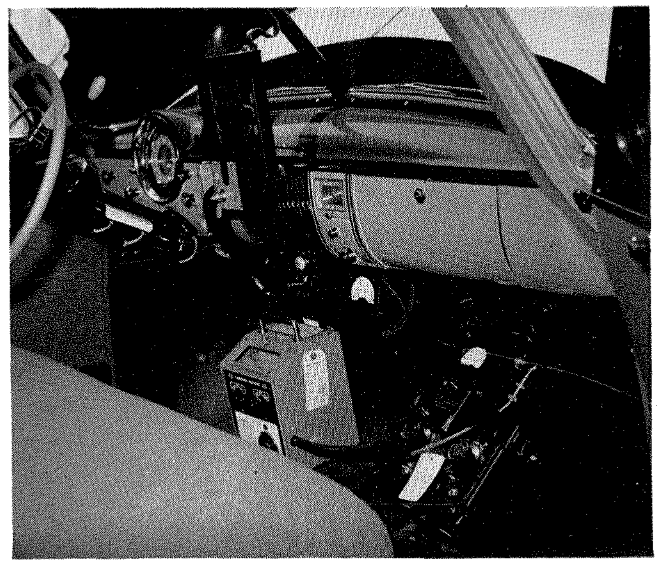
(2) Choking: If you have a manual choke, you are a lucky man. Choke as little as you can. It wastes gasoline, increases cylinder wear and results in dilution of the crankcase oil. If you have an automatic choke, it most likely overchokes. The least that should be done is to keep the choking mechanism in tip-top shape (some more about upkeep later).

3) Warm-up is good, especially with automatic choke, but it costs gasoline, too. So don't overdo it. Warm-up should be rather fast (1000 rpm). Most carburetors have a fast idling provision. After about 2½ minutes of fast idle the cylinder walls are warm enough to prevent excessive condensation (which causes cylinder corrosion). You can now safely take off.

(4) Take it easy until the engine is at normal temperature as indicated by the thermometer on the dash.



Instrumentation for road testing — tachometer (reading engine rpm) is next to steering pole; manifold pressure gauge is below left hand corner of dash.



Instrumentation for road testing — fuel consumption burette is above center of dash; altimeter and thermocouple (reading engine temperatures) are under radio grille; sound level meter for knock indication is at lower right; grey box is exhaust gas analyzer.

(5) Don't pump the accelerator while waiting at stops.

(6) Don't take off from stops like a race driver. It costs plenty and does not materially speed up your progress. In other words, don't bear down on the accelerator and accelerate with full throttle. (This is called driving with a "heavy foot", whence this article gets its title.)

(7) Use brakes as little as possible. This means that you should plan your stops wherever you can.

(8) If you have a conventional transmission, do not drive in low gears at high engine speed. It sounds sporty, that's all. Shift into high as soon as possible, and use overdrive where you can.

(9) If you have an automatic transmission, rapid acceleration results in excessive consumption more drastically than with conventional transmission. Allow the engine to pick up the load at part throttle (remember the efficiency curves of a torque converter in Chart 4).

What about the condition of the car?

A reasonable schedule of engine tune-up is as important as regular lubrication. Periods between tune-ups vary. 10,000 miles is a reasonable figure. Such a tune-up consists of a check of carburetor and ignition. Here are a few points to look for:

Intake air filter as well as crankcase breathers should be kept clean.

Choke and carburetor preheater need special attention.

Bad ignition timing, poor breaker points as well as over-aged and dirty plugs spoil performance.

Valve adjustment also affects timing, hence performance.

Remember that you judge performance mainly by *acceleration.* You automatically compensate for any loss of power by increasing the throttle. Hence, as you lose power, *you operate with progressively wider throttle.* This brings you not only into the high consumption range in steady driving, but also results in more frequent and extensive use of the accelerator pump.

Some secondary effects worth noting

Low tire pressure increases road resistance and costs gasoline.

Keep your starting system in good shape. This means that the battery should be kept up, starter commutator and switch kept clean. Otherwise fuel is wasted in lengthy starting.

Low viscosity oil does not improve economy (a change from SAE 30 to 10 results in an improvement of approximately 0.3 mpg).

Appendix

Fuel consumption reported in the preceding passages was measured by means of a flow meter, pictured on page 14, which shows the instrumentation of a Chevrolet for road testing. The meter consists of a burette of 1/10 gallon which can be filled while under way and then switched to the carburetor. Other instruments are 12 thermocouples installed in various places on the engine. Engine rpm and manifold pressure are also measured and are used to get the power available from the power chart (such as Chart 2). Altimeter and psychrometer are needed to correct power for atmospheric conditions. A sound level meter is used for checking knock in the engine while driving. The microphone is mounted under the hood.

Acceleration is measured by successive timing.

1951 MOBILGAS ECONOMY RUN

Class & Price	Place	Car Make	Type	Ton-Miles per gallon	Miles per gallon	Miles per hour
A $1400-1750	1	Ford	V-8	54.587	25.994	40.570
	2	Studebaker	Champion	54.381	28.621	40.474
	3	Ford	6	53.838	25.915	40.288
	4	Plymouth	Cranbrook	47.934	22.990	40.627
	5	Chevrolet	Styleline	45.956	22.041	40.475
B $1751-1950	1	Studebaker	Commander	58.173	28.001	40.465
	2	Nash	Statesman	52.637	26.122	40.338
C $1951-2175	1	Mercury		59.860	25.945	40.316
	2	Studebaker	Landcruiser	58.744	27.644	40.240
	3	Nash	Ambassador	58.268	25.926	40.487
	4	Kaiser		52.828	24.773	40.800
	5	DeSoto	DeLuxe	51.135	21.622	40.319
D $2176-2450	1	Packard	"200"	53.020	22.023	40.595
	2	Chrysler	Windsor	52.268	20.886	40.568
	3	DeSoto	Custom	47.760	19.921	40.601
	4	Hudson	Commodore 6	46.723	19.590	40.583
E $2451-2700	1	LINCOLN		66.484	25.448	40.487
	2	Hudson	Hornet 6	53.785	22.623	40.565
F $2701-3000	1	Cadillac	61	55.492	21.719	40.488
	2	Packard	"300"	52.196	20.941	41.414
G $3001-3300	1	Chrysler	Imperial V8	59.457	21.178	40.395
	2	Cadillac	62	56.412	21.531	40.329
	3	Lincoln	Cosmopolitan	47.601	17.123	40.899
H $3301-4000	1	Cadillac	60 Special	58.795	21.979	40.395
I $4001-6000	1	Chrysler	Crown Imperial	63.289	19.208	40.265
	2	Cadillac	75	58.513	19.869	40.474
Special 4 Cylinder	1	Henry J	4	49.153	30.109	41.701
	2	Willys	Jeepster	46.110	26.769	40.741
Special 6 Cylinder	1	Nash	Rambler	53.489	31.053	41.132
	2	Plymouth	Concord	48.954	24.143	40.697
	3	Henry J	6	48.340	28.860	40.680
	4	Willys	Jeepster	43.266	24.973	40.542
Average		All Cars		66.484	25.448	40.487