PERFORMANCE RATING FACTORS

For All 1955 Cars

ENGINE POWER **ACCELERATION** **TOP SPEED**

BY ROGER HUNTINGTON

WE ROAD-TESTED a '48 Ford the other day that had its engine modified up to the equivalent of maybe 175 advertised rated horsepower. The times we got would barely match a *stock* '55 Buick Century! Moral: Brute road performance—in just the last four or five years—has become as important a factor in selling cars as styling, economy, or price. To put it bluntly, the public's gone in for performance . . . but in a real nice, quiet, factory-sponsored way.

In view of all this current interest in performance, it's interesting to derive some comparative factors on the various '55 models and tabulate them against each other. Of course, a careful road test against the stop-watch is the only way to determine definitely what any car will do. But this might be a good way to bring out some of the factors of design that determine the road performance of an automobile, as well as giving you a yardstick for measuring your car against the neighbor's.

Another advantage of rating cars by slide rule is that we can put each one on absolutely the same basis by using only published manufacturers' specifications with which to calculate them; in road testing, driver technique, weather conditions, and so forth can have quite an effect. Some of the factors we'll talk about—like the weight/power ratio—you're familiar with; others, like the horsepower per square foot of frontal area, are vital in the performance picture, but not well understood by the average enthusiast.

ENGINE POWER

PISTON displacement has been the most popular basis on which to rate engines in various kinds of racing and speed competition for 50 years.

In any internal-combustion engine the amount of fuel-air mixture you can pump *per revolution* is a vital factor in the performance. This depends on the displacement of the cylinders and the efficiency of breathing. Now torque—or the maximum twisting effort the engine can exert on the crankshaft—depends on the amount of mixture pumped and how efficiently it is burned, which is a function mostly of compression ratio.

In other words, if we rate our engines on a basis of torque output (measured in pound-feet) per cubic inch of displacement, the resulting figure will be indicative of the medium-speed breathing efficiency and how well the engine utilizes its compression ratio and fuel combustion characteristics.

Horsepower, on the other hand, depends not only on the torque, but on *how fast* this twisting effort can be applied—or the rpm. The more horsepower you can get out of a given number of cubic inches obviously the more efficient the engine is from the standpoints of rpm potential, balance, friction loss, breathing, compression pressure, etc.

By limiting a designer on his piston displacement you force him to go to work and develop all these factors which make for a more efficient, compact, and economical power plant. So I don't think we can do any better than follow the competition boys and rate our '55 passenger car engines on a basis of horsepower per cubic inch and torque per cubic inch.

RATINGS FOR ACCELERATION AND TOP SPEED CONTINUED ON PAGES 20, 21

	MODEL	H.P. PER CUBIC INCH	TORQUE PER CUBIC INCH
Buick	Special	.71	.97
	Century	.73	1.03
	Super	.73	1.03
	Roadmaster	.73	1.03
Cadillac	62	.76	1.04
	60	.76	1.04
	75	.76	1.04
	Eldorado	.82	1.06
Chevrolet	6 Stock Shift	.52	.88
	Powerglide 6	.58	.89
	V-8	.61	.97
	With power pack	.68	.98
	Corvette 6	.64	.95
	Corvette V-8	.68	.98
Chrysler	Windsor	.62	.91
	New Yorker	.76	1.03
	"300"	.91	—
De Soto	Firedome	.64	.84
	Fireflite	.69	.94
Dodge	Coronet 6	.53	.84
	Coronet V-8	.65	.89
	With power pack	.72	.91
	Cu tom Royal V-8	.68	.91
	With power pack	.72	.91
Ford	6	.54	.87
	V-8	.60	.95
	With power pack	.67	.99
	Thunderbird	.68	.98
Hudson	Wasp	.54	.78
	With power pack	.59	.83
	Hornet 6	.52	.86
	With power pack	.55	.90
	Hornet V-8	.65	.94
	Italia	.59	.83
Imperial		.76	1.03
Kaiser		.62	.95
Lincoln		.66	1.00
Mercury		.64	.94
	Montclair	.68	.98
Nash	Metropolitan	.57	.85
	Statesman	.51	.79
	With power pack	.56	.79
	Ambassador 6	.51	.87
	With power pack	.55	.91
	Ambassador V-8	.65	.94
	Healey	.56	.91
Oldsmobile	88	.57	.99
	Super 88	.62	1.03
	98	.62	1.03
Packard	Clipper	.70	1.02
	Custom Clipper	.70	1.01
	Patrician 400	.74	1.01
	Caribbean	.78	1.01
Plymouth	6	.51	.84
	V-8 (167 hp)	.64	.89
	With power pack	.68	.89
Pontiac	Chieftan	.63	.92
	With power pack	.70	.97
	Star Chief	.63	.92
	With power pack	.70	.97
Rambler		.46	.77
Studebaker	Champion	.54	.82
	Commander	.63	.97
	With power pack	.70	1.00
	President	.71	1.00
Willys		.51	.84

	MODEL	LBS. PER HORSEPOWER	ACCELERATION FACTOR Automatic Transmission	ACCELERATION FACTOR Standard Transmission
Buick	Special	22.6	.22	.24
	Century	18.3	.26	.30
	Super	19.7	.24	.28
	Roadmaster	20.3	.23	—
Cadillac	62	19.5	.24	—
	60	20.1	.23	—
	75	22.1	.24	—
	Eldorado	19.7	.22	—
Chevrolet	6 Stick Shift	29.5	—	.21
	Powerglide 6	27.4	.20	—
	V-8	22.5	.25	.26
	Corvette 6	21.7	.24	—
	Corvette V-8	17.7	.29	.30
Chrysler	Windsor	23.5	.22	.23
	New Yorker	18.7	.24	—
	"300"	16.0*	—	—
DeSoto	Firedome	23.6	.21	.22
	Fireflite	22.2	.22	.23
Dodge	Coronet 6	30.9	.19	.20
	Coronet V-8	22.3	.22	.23
	With power pack	20.2	.22	.23
	Custom Royal V-8	21.8	.22	.23
	With power pack	20.6	.22	.23
Ford	6	30.3	18	.21
	V-8	23.1	23	.26
	With power pack	20.5	24	27
	Thunderbird	17.6	27	31
Hudson	Wasp	32.4	.16	18
	With power pack	29.8	.17	.19
	Hornet 6	24.9	.21	.27
	With power pack	23.4	.22	.29
	Hornet V-8	19.1	27	—
	Italia	26.7	—	.21
Imperial		20.3	23	.25
Kaiser		27.0	19	.22
Lincoln		21.2	.22	—
Mercury		21.0	22	.26
	Montclair	20.2	.23	.27
Nash	Metropolitan	56.4	—	.12
	Statesman	35.7	.16	.19
	With power pack	32.4	.16	.19
	Ambassador 6	30.6	17	.23
	With power pack	28.4	18	.24
	Ambassador V-8	19.1	.27	—
	Healey	23.6	—	.29
Oldsmobile	88	22.8	.23	.28
	Super 88	21.1	.25	.28
	98	21.6	.26	—
Packard	Clipper	19.1	.23	.29
	Custom Clipper	18.1	.26	.31
	Patrician 400	18.7	.24	—
	Caribbean	18.5*	.23*	—
Plymouth	6	31.1	.20	.20
	V-8 (167 hp)	22.4	.22	.23
	With power pack	21.2	.22	.23
Pontiac	Chieftain	22.4	.20	.24
	With power pack	20.1	.21	.25
	Star Chief	22.5	.21	.24
	With power pack	20.2	.22	.25
Rambler		34.8	.16	.18
Studebaker	Champion	32.7	.16	.19
	Commander	22.0	.25	.27
	With power pack	19.6	.26	.28
	President	20.1	.25	.27
Willys		29.4	.19	.21

*Estimated

ACCELERATION

THERE'S no better or simpler yardstick for measuring the overall acceleration of a car—at least up to 70 or 80 mph—than the old power-to-weight ratio. If you take a flock of, say, 0-60 mph times for many different cars and plot them on a graph against the weight/power ratios of those same cars, you'll find that the various points tend to fall on a smooth curve. To the engineer, this indicates there is definite correlation between the two values.

For the weight factor I'm using a logical *gross weight* figure—manufacturer's shipping weight for the four-door sedan, plus 500 lbs. for a normal passenger load, luggage, fuel and water. If you don't do this the lighter cars will tend to look better because loading will pull their acceleration down more.

Torque is the deciding factor in acceleration only under certain conditions. With modern automatic transmissions we "kick down" into a lower gear for most full-throttle acceleration—which puts the rpm over 3000 and brings the peak of hp curve into the picture.

Perhaps it would be best if we used a factor obtained by multiplying torque by the axle ratio, and dividing by gross weight. This is logical because the thrust on the tires—or the push that accelerates the car—is directly proportional to torque times the gear ratio; and the actual rate of acceleration is proportional to the net accelerating force divided by car weight. This factor should give quite consistent results up to speeds where wind resistance becomes important, or at least 70 mph. The table at left shows this *acceleration factor* for both automatic and standard transmission axle ratios. Remember, these ratings aren't applicable in a lower gear; then the simple weight/power ratio probably would be a better index.

TOP SPEED

IT TAKES horsepower—honest horsepower—to go fast . . . torque doesn't cut any ice here. And the power required to move a big, hefty Detroiter shoots up awfully fast as the speed goes over 90 or 100 mph; an extra 10 hp isn't going to give another five mph by any means. But maybe this weird power-speed relationship isn't such a tough nut after all.

In the first place, modern U.S. cars are geared in such a way that the peak of their horsepower curve falls quite close to maximum speed on a level road. This eliminates the factor of gear ratio in the problem—in other words, we can consider all our power as being available to produce speed.

Total drag or resistance of a car at top speed is made up roughly of 10 per cent friction, 25 per cent tire resistance, while the remainder is air drag. These factors needn't complicate things too much. All modern U.S. cars are so much alike in general shape that, if they were all reduced to the same relative size, I don't think air drag would vary over a range of more than 10 per cent on all of them. So let's eliminate the factor of shape. That leaves frontal area. This will vary from around 23 to 30 square feet on current models. Now, tire rolling resistance, at normal inflation pressures, is a function of the car *weight*—and it will increase very roughly as the square of speed. Same deal with chassis friction. And here's the payoff: *Car weight is quite closely related to frontal area.* Get the picture now? We can logically base the total drag of our cars as a simple function of their height times width!

As a matter of fact, we should be able to compute these factors further and get actual top speed in mph. So the accompanying list shows these speed factors for the various cars, plus a theoretical top speed figure. •

	MODEL	SPEED FACTOR	THEORETICAL TOP SPEED
Buick	Special	1.81	105
	Century	1.94	113
	Super	1.89	110
	Roadmaster	1.89	110
Cadillac	62	1.94	113
	60	1.94	113
	75	1.92	111
	Eldorado	2.01	117
Chevrolet	6 Stick Shift	1.57	91
	Powerglide 6	1.62	94
	V-8	1.72	100
	With power pack	1.78	103
	Corvette 6	1.79	104
	Corvette V-8	1.94	113
Chrysler	Windsor	1.78	103
	New Yorker	1.96	114
	"300"	2.10*	122
DeSoto	Firedome	1.78	103
	Firefite	1.82	106
Dodge	Coronet 6	1.58	92
	Coronet V-8	1.78	103
	With power pack	1.84	107
	Custom Royal V-8	1.80	104
	With power pack	1.84	107
Ford	6	1.55	90
	V-8	1.72	100
	With power pack	1.78	103
	Thunderbird	1.98	115
Hudson	Wasp	1.48	86
	With power pack	1.53	89
	Hornet 6	1.68	97
	With power pack	1.71	99
	Hornet V-8	1.83	106
	Italia	1.64	95
Imperial		1.95	113
Kaiser		1.65	96
Lincoln		1.88	109
Mercury		1.80	104
	Montclair	1.85	107
Nash	Metropolitan	1.22	71
	Statesman	1.44	84
	With power pack	1.49	86
	Ambassador 6	1.57	91
	With power pack	1.61	93
	Ambassador V-8	1.83	106
	Healey	1.86	108
Oldsmobile	88	1.78	103
	Super 88	1.84	107
	98	1.84	107
Packard	Clipper	1.88	109
	Custom Clipper	1.94	113
	Patrician 400	1.98	115
	Caribbean	2.03*	118*
Plymouth	6	1.55	90
	V-8 (167 hp)	1.75	102
	With power pack	1.79	104
Pontiac	Chieftain	1.78	103
	With power pack	1.85	107
	Star Chief	1.78	103
	With power pack	1.85	107
Rambler		1.44	84
Studebaker	Champion	1.51	88
	Commander	1.76	102
	With power pack	1.83	106
	President	1.84	107
Willys		1.56	91

*Estimated