

ET FROM RACECAR WEIGHT & HORSEPOWER

Let's get back to simple relationships from drag race performance. In our past articles, some simple math relations were reviewed to help with run analysis. We reviewed two of these in DRM issue 18 and 20 from 2006. They were as follows:

$$HP = (\text{vehicle weight} \times 200) / (\text{ET} \times \text{ET} \times \text{ET})$$

$$HP = \text{vehicle weight} \times (\text{MPH} / 234) \times (\text{MPH} / 234) \times (\text{MPH} / 234)$$

Actual horsepower, vehicle weight, ET and MPH were examined to develop these relationships (called algorithms). Several examples were also provided in the articles that were from various IHRA drag race vehicles. Again, my experience with these math relationships was quite successful as tuning analysis tools.

A THIRD RELATIONSHIP: Going the other way in the first relationship from above, there is a different solution:

$$\text{ET} = (\text{vehicle weight} \times 200 / \text{HP}) \text{ to the one third power}$$

The words "to the one third power" can scare some. It forced me to review math from my school days. However, today a simple scientific calculator can run the numbers at will. The function xy is the math function to select from the calculator. The variable "x" is the result from vehicle weight times 200/HP. The variable "y" is $1/3$ rd or 0.33333...

TOP FUEL DRAGSTER: Going back to one of the spectator favorites, Top Fuel Dragster, we can examine some values that I played with: vehicle weight = 2,400 race weight (with fuel, oil, etc.) and HP = 5,300. With those values, the ET computes to 4.49 seconds (Clay Millican's Werner Enterprises, Top Fuel Dragster National Record). Don Jackson Engineering measured power levels far beyond that from his on-board dyno instrumentation. However, the calculated values show the amount of horsepower that is getting to the ground. Again remember the horsepower loss from aerodynamics and the slipper clutch. Those items consume much horsepower that is not indicated by the final racecar performance.

TOP FUEL FUNNYCAR: Look now at Bob Gilbertson's Autolite, Trick Tank, 10,000 RPM Clutches, '05 Dodge Stratus Funnycar run record of 4.841 at San Antonio. Weighing in at an average estimate of 2,500 pounds, the Top Fuel Funnycar performance can be noted from the following:

$$\text{ET} = (2,500 \times 200 / 4,400) \text{ to the one third power} = 4.84 \text{ seconds}$$

Again with the addition of a lot higher frontal area compared to the Dragster as well as the other losses, a reduced amount of horsepower over Top Fuel is noted. These relationships are more novel and less meaningful than looking at other IHRA vehicles where the tires are hooked up, most of the run.

OTHER IHRA CLASSES and their class speed records:

CLASS, DRIVER, DESCRIPTION, APPROX. WEIGHT*, ET RECORD, HP REQ'D FOR ET

Pro Mod, Scott Cannon, '06 GTO Hemi 526, 2,800, 6.019, 2,566

Alc. FC, Rob Atchison, '02 Firebird / Chevy, 2,300, 5.685, 2,502

Pro Stock, Robert Patrick, '06 Shelby GT500/Ford 817, 2,450, 6.315, 1,950

*Exact weights were not available; author estimated weights for illustrative purposes only.

ANALYSIS: The power levels that are shown do not necessarily reflect the losses from aerodynamic loading and tire spin. Alcohol Funnycar is an example where black tracking (tire spin) even in high gear is common and the ET does not reflect the true power. As you get to slower vehicles, the numbers are more realistic.

OTHER RACECARS: Looking at other combinations, the ET is calculated from the various power levels and vehicle weights from different classes:

CLASS	APPROX. WEIGHT	DYNO HORSE-POWER	ET (1/4)
Stock Eliminator	3,000	150	15.87
Stock Eliminator	3,200	350	12.23
Stock Eliminator	3,200	400	11.70
Super Stock	3,200	500	10.86
Super Stock	3,200	600	10.22
Super Stock	3,200	700	9.71
Hot Rod	2,600	401	10.90
Super Rod	2,300	473	9.90
Quick Rod	1,900	538	8.90
Top Sportsman	2,350	1,300	7.12
Top Dragster	1,900	1,300	6.64

STILL ANOTHER FIRST IN IHRA DRM! Regarding the 1/8th mile, recall the determination for horsepower from weight and the 1/8th mile ET. They were derived from quarter mile relations in the previous DRM Tech Stop article in Issue #15 from 2006.

$$HP = \text{vehicle weight} \times 52 / (\text{ET} \times \text{ET} \times \text{ET})$$

Going in the other direction:

$$\text{ET} = (\text{vehicle weight} \times 52 / \text{HP}) \text{ to the one third power}$$

Reexamine the previous table for quarter mile ET's, but revised for eighth mile ET's:

CLASS	APPROX. WEIGHT	DYNO HORSE-POWER	ET (1/8)
Stock Eliminator	3,000	150	10.12
Stock Eliminator	3,200	350	7.80
Stock Eliminator	3,200	400	7.46
Super Stock	3,200	500	6.93

Super Stock	3,200	600	6.52
Super Stock	3,200	700	6.19
Hot Rod	2,600	401	6.96
Super Rod	2,300	473	6.32
Quick Rod	1,900	538	5.68
Top Sportsman	2,350	1,300	4.55
Top Dragster	1,900	1,300	4.24

These algorithms are based on the original relationships done by Chrysler racing in the '60s. With advances in tire traction, new relationships may be needed in many IHRA class racecars. If the results from your racecar do not quite fit these numbers, try changing those multipliers: 200 for the quarter mile relation and 52 for the eighth mile relation. Whether you use the algorithm in these articles or determine new ones for your racecar, you can now watch your run performance. For quarter mile runs, you can examine your ET from horsepower and horsepower from ET. You can examine your eighth mile performance that is within your quarter mile timing slips. You may be OK in the eighth and down on power in the quarter. That could indicate a high-end problem and rule out many low-end suspects.

TRICK: For those without a scientific calculator, play with the numbers by picking an ET and multiplying it by itself three times to see if it matches the relationship on the right of the equals sign. You can use the following for the quarter mile numbers:

$$\text{ET} \times \text{ET} \times \text{ET} = (\text{vehicle weight} \times 200 / \text{HP})$$

You can use the following for the eighth mile numbers:

$$\text{ET} \times \text{ET} \times \text{ET} = (\text{vehicle weight} \times 52 / \text{HP})$$



Bob Szabo is an owner / driver of a blown alcohol drag racecar and one of the few technical racing book authors. His new book: "5,000 Horsepower on Methanol, with Nitro, Racing Gas, Nitrous, & Ethanol

Technology" covers fuel injection, carburetors, normally aspirated, supercharged, and turbocharged setups. His current book, "Fuel Injection Racing Secrets" provides extensive tuning info for fuel injection, both normally aspirated & supercharged, for all of the various fuels. Both are becoming popular gifts for birthday and anniversaries such as that first 9 or 8 or 7 second ET! Check the DRM Yellow Pages for Szabo Publishing or look on the internet at <http://www.racecarbook.com> or call (707) 446 2917.