TECH STOP

HORSEPOWER FROM RACECAR WEIGHT & SPEED

by Robert Szabo

Simple relationships occur throughout our sport some of which can be used to further evaluate our performance levels. Recall the relationship between horsepower, racecar weight, and elapse time that was discussed in a previous issue of DRM:

HP = (vehicle weight x 200) / (ET x ET x ET)

It turns out that the developers of that relationship (Mopar I believe) did one for vehicle weight and quarter mile speed:

HP = vehicle weight x (MPH / 234) x (MPH / 234) x (MPH / 234)

As in the previous relationship, this was derived by horsepower measurements, then comparing them to various vehicle performance levels. My experience with this math relationship was equally successful as with the last relationship. The relationship for MPH indicates a minimum horsepower, not necessarily the maximum. Engine power may be a lot more with vehicle speed limited from clutch, converter, or tire slippage – and / or aerodynamic drag.

TOP FUEL DRAGSTER: Examining some of the IHRA drag racecars, the first one to consider is Top Fuel Dragster. According to the September 15th issue of DRM (issue #17), the Clay Millican Werner Enterprises Hadman built Top Fuel Dragster has the record at 326.63 MPH at Cordova. The car weight is approximately 2,300 pounds. That is an average of about 2,400+ pounds beginning the burnout with a full tank of nitro and close to 2,200 pounds (minimum weight) at the end of the run without fuel. The numbers are put into the math as follows:

HP = 2,300 x (326.63 / 234) x (326.63 / 234) x (326.63 / 234) = 6,255 HP

Oh my! Yes these cars are up there. Keep in mind that the aerodynamics, that is the rear and front wings, consume a considerable amount of power. In fact, about the best lift to drag ratio for a wing on racecars is about 3.5 to one. So for every 3.5 pounds of negative lift, there is about one pound of drag. Some of the figures circulating around are more than 1,200 horsepower loss due to drag in the rear wing of a Top Fueler. Examining the sheer size of the wings gives an indication of the number of pounds of aerodynamic drag converted to negative lift and the horsepower loss from that aerodynamic drag. With that in mind as well as the realization that the vehicle has frontal area, an open cockpit and protruding magnetos, injector, & various other equipment all with wind gusting, and a slider clutch that goes almost into melt-down on a run from slippage, the actual amount of horsepower in a Top Fueler is some level well above 7,000.

TOP FUEL FUNNYCAR: Look now at Cruz Pedrigon's Advance Auto Parts, Q, Great Stuff Monte Carlo/TFX run record of 309.2 MPH at San Antonio. Weighing in at an average estimate of 2,500 pounds, the Top Fuel Funnycar performance can be noted from the following:

HP = 2,500 x (309.2/234) x (309.2/234) x (309.2/234) = 5,768 HP

With many of the same losses in mind except with the addition of a lot higher frontal area compared to the Dragster, an elevated amount of horsepower is again noted. In addition, the Top Fuel Funnycar competition is in its infant stages at IHRA. With comparable engine technology as the Top Fuel Dragster competition, record speeds from Pedrigon's Advance Auto Parts, Q, Great Stuff Monte Carlo and others are expected to go up.

LOOKING AT OTHER IHRA CLASSES and their class speed records:

						for comparison	for comparison
					from speed		from ET
class	driver	Description	approx. weight*	MPH record	HP req'd	ET record	HP required
Pro Mod	Josh Hernandez	'68 Camero BAE 524	2,800	237.07>>>	2,912		
Pro Mod	Mike Bell	'66 Mustang BAE	2,800			6.046>>>	2,533
Alc. FC	Jim Sickles	'05 Monte Carlo 526	2,300	248.75>>>	2,763		
Alc. FC	Rob Atchison	'02 Firebird / Chevy	2,300			5.685>>>	2,504
Pro Stock	Frank Gugliotta	'04 Escort / 815 Ford	2,450	220.26>>>	2,043		
Pro Stock	Robert Patrick	'04Cobra Mustang / Ford	2,450			6.360>>>	1,905

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

ANALYSIS: Comparing the HP derived from the MPH and the HP derived from ET, it looks like more power is derived from the speeds than from the ET's in the above cases. That would indicate that these high powered cars may be spinning the tires for the ET run records. They are getting slower ET's than what would be generated from hooking up the whole way down from the power indicated by the speed. One value that stands out is Hernandez' 237 MPH run and the 2,900 HP needed to do that. The tune-up was right-on for that run. In fact, that is a spectacular level of performance. Realize that Pro Mod racecars with superchargers are limited to 20% overdrive. Alcohol Funnycars are not limited. Overdrives of 50% are typical. At the higher overdrive, the blower pumps more air. The purpose is to make more power from more air and an increase in fuel that is necessary for that extra air. As a result, more power from the Funnycar ranks would be expected. However, a merging trend is appearing in the supercharged ranks: that of intake manifold temperature control. From several sources, I was told that supercharged engines have intake manifold temperature limits. Beyond a temperature somewhere between 180 and 220 deg. F depending on the tune-up, power becomes difficult to maintain and reproduce. During a run, the blower and manifold build up temperature. After some point, power tends to drop. Some tune-ups are responding well to a REDUCTION in blower overdrive. That reduction postpones the temperature increase. The engine remains at a good power level for a longer period of time. And some classes are making more performance as a result. Pro Mod is an example.

DOORSLAMMERS: Looking at various stock classes, note the following:

						for comparison	for comparison
					from speed		from ET
class	driver	Description	approx. weight*	MPH record	HP req'd	ET record	HP required
SS/PEA	Slate Cummings	'98 Firebird Pontiac / 350	3,200	143.40	736	9.407	769
SS/PHA	Ashley Parker	'69 Mustang / 289	3,100	122.60	446	10.953	470
V/S	Tom Gould	'66 Corvair / Chev. 164	2,600	88.47	141	14.81	160
M/SA	Mike Mahew	'77 Olds Cutlass 403	3,600	106.73	342	12.01	416
B/CM	Terry Taylor	'75 Corvette 502	3,400	131.28	600	10.049	670

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ANALYSIS: In this case, horsepower to turn the ET's was higher than the amount to turn the speeds. This would indicate that the IHRA track surface is really hooking up these racecars. They are turning ET's that need less power than the speeds that they are running. It is an interesting contrast to the higher-powered racecars. One of the values of this analysis is that racers can examine vehicles and engines from various classes. Racers can see how much power is made in the various classes and can see how other competitors in the same class are running. They can see if it would be an attractive class to enter or to stay in (if they are already there). Realize that it may be more difficult making 160 horsepower from a 164 cubic inch Corvair, within the Stock Eliminator rules, than 600 horsepower from a 502 in the Crate Motor class rules.

ANOTHER FIRST IN IHRA DRM! Regarding the 1/8th mile, recall the determination for horsepower from weight and 1/8th mile ET that was derived from the quarter mile relations in that previous DRM article.

HP = vehicle weight x 52 / ET x ET x ET)

The 1/8th mile relationship was determined for horsepower from weight and speed:

HP = vehicle weight x (MPH / 0.8) / 234) x (MPH / 0.8) / 234) x (MPH / 0.8) / 234)

HP = vehicle weight x (MPH / 187) x (MPH / 187) x (MPH / 187)

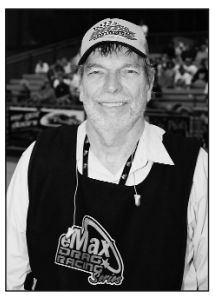
IHRA RACECAR EXAMPLES: Looking further at other IHRA classes:

						for comparison	for comparison
					from speed		from ET
class	driver	Description	approx. weight*	MPH record	HP req'd	ET record	HP required
B/CM 1/4	Terry Taylor	'75 Corvette 502	3,400	131.28	600	10.049	670
B/CM 1/8	Terry Taylor	'75 Corvette 502	3,400	106.22	621	6.405	623
SS/PGA 1/4	Steven Johnson	'68 Camero 302	3,000	140.94	655	9.403	721
SS/PGA 1/8	Steven Johnson	'68 Camero 302	3,000	114.25	681	5.986	684

*exact weights were not available; author estimated weights provided for illustrative purposes only

ANALYSIS: Analysis can reveal again good power from the ET values for both the quarter and eighth mile times. I can only imagine what a racer can do with this math and dyno readings from his racecar. Those quarter mile ET's from both of these classes are way down there. Incidentally, most quarter mile racetrack timing systems provide eighth mile speeds and ET's. The eighth mile performance values can be examined as well as the quarter mile values from the same run to determine the race vehicle strengths and weaknesses. ET's may indicate more power if the vehicle ran on an exceptional track surface and / or in better weather or altitude. Looking at the eighth mile marker values within the quarter mile runs may provide closer power values for both distances. Keep in mind that the math for the eighth was from two derivations. Some adjustment factor added into the math may be needed. That adjustment may be different for different classes and power levels. It is thought by some that the horsepower derived from the speed is more accurate. Changes in gearing, for example, usually have a much greater effect on ET than on speed. A lower ET from good gearing may indicate a higher power level than that of a higher ET from less favorable gearing.

NOTE: As a courtesy from IHRA to our readers, previous Tech Stop articles can be viewed or downloaded from my web site shown below.



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