Blooze Transmission Calculator Instructions

Transmission Worksheet V 1.2 - 07/17/07

07-17-2007

Changed link to point at the updated spread sheet with the Gear Spreader in it. And this is a link directly to the post that discusses it
http://forums.forzamotorsport.net/forums/permalink/370040/562793/ShowThread.aspx#562793

Also modified the text of this document to link to Tonka's post about getting a good reading on torque values from the telemetry screen. Thanks Tonka  .

06-28-2007

Function Error: The whiz kid here used a bogus value for pi in the circumferance calculation. The function is in Cell O2 which contains **=(N2*3.14714)/12.** Replace the highlighted numbers 714 with the numbers 159. The error will have little affect on what you have done, cost you maybe .2 mph in the very highest speeds, but it was an error none the less.

A tip of the hat to ***Target17*** for catching this one. 

06-26-2007

Since I own the post directly after this one, I have used it to contain a description of how to populate the template. The addresses have been modified from the ones in the description below which actually more about building the calculator from scratch. Included will be descriptions on where in Forza to look for the information.

This is a post I made in the Torque vs. Horsepower thread earlier today. I broke it out so that I could share it with others who might not have gotten into that thread.

First of all, Kudos to R3V4N, he has busted his *ss in this thread. I have a few things to toss into the fracus on this discussion. Most of it will be a re-iteration of what R3V4N has posted, but perhaps with a bit different spin on it - pointed more towards the practical factors of the information - setting up a spreadsheet to help make use of the knowledge and apply it to not only finding your shift points, but to actually building your transmission.

Now, a bit of discussion about Torquers vs. Rappers. I saw where somebody said that the torque is a factor of displacement - that is not necessarily true. Consider two engines - both V8s, both 302 ci. The only difference is how they get their displacement. One has a 4" bore and a 3" stroke - what we call "overbore" (the 327 Chevy is a famous example). The other has a 3" bore and a 4" stroke - it has a bore to stroke ratio over 1 - a stroker (the 389 Pontiac is a famous example of this type of engine). Now picture a figure skater doing a spin... she starts out with her arms spread wide, and as she moves her arms in, she starts spinning faster. It is sort of the same principle in the engines, the one with the bigger stroke will not spin as fast. The one that spins faster will not make as much torque. There is somewhat simplified, there are other things to consider - rod angle for one, but it will

suffice to show why we have to have a different perspective considering gears for the two cars.

The overbore car will rap up faster, but only if it has enough torque to get the car's mass moving without bogging down. This is solved with higher ratio gearing. Another problem is it will not take bogging in a turn well - you will have to down shift or lose your momentum.

The stroker will get moving easy but will give it up on the top end because it doesn't have the RPM, again, we can fix this with lower ratio gearing. Another problem with this type is low speed torque breaking the tires loose. The Shelby GT 500 puts out a massive amount of torque at slow engine speeds - it will spin your tires in a heart beat in the lower gears.

So let's build the transmission. A decision you might want to make now with a stroker is that if you will build a 5 speed transmission. This can be dictated by the first task. Find the terminal velocity of the car. This the speed at which the power the car is producing is equal to the forces against it - it quite simply will not go any faster than this. You must either reduce the friction coefficient or increase the power to go faster. Once you have configured the car for class, you are done here, and since the friction coefficient is not available to us, we can't compute it mathmatically.

The first thing to do is let out your FD a lot, enough to find the point where the Top Speed in the benchmark quits increasing and starts dropping. Now start increasing the FD incrementally until the TS once again quits increasing. You will have it pretty close here. Go on the Nissan and mess with it a little, up and down until you are satisfied that you have it going as fast as it will go. This is your terminal velocity. Take note of this number. Multiply the last (5th or 6th) gear's ratio x the Final Drive ratio. Now it doesn't matter what ratios you have in the FD or gears now, as long as the product of the two is equal to the Total gearing number you wrote down. It may be worth mentioning here, but I always cheat toward leaving a little of the TS on the table in favor of getting to the TS faster. The rate of accelleration diminishes as the amount of torque multiplication decreases. There is no value to having a topspeed that takes you 5 miles and no head wind to reach.

Now we need to set our first gear. Practice launching on the test track (hold the brake down and release it when you have your engine rapped up. Raise or lower you first gear based on wheel spin and bog until you have it launching the way you want it to. Now you have your first gear set. Time to build the spreadsheet.

If you holler whoa - no Excell or Lotus here, dog gone... this is going to be tough. You can do it with an eight column book-keeping sheet, but it will be tough and labor intensive. I will continue like you have one available to you.

I'll 'splain the parts... (if you try to build this, be aware of where you are on your spreadsheet (your columns may not match mine) and the the absolute referencing. If you get that wrong, you will have junk.

- Cell V1 contains the RPM increment value.
- Cell U5 is the starting RPM input. I haven't found a car that had a range that this number of rows would not cover. Cell U6 contains a formula **=U5+V1.** Copy it to the range U6 - U29
- Cell U40 contains the shift point RPM input. Cell U39 contains the formula **=U40-V1,** copy it range U33 - U39
- Cell V2 is the Final Drive input.
- Cells V5 - V29 contain the torque values of the associated RPM. I will have more to say about where these numbers come from. I get them from the graph, and it is a b*tch, I'll tell you. The thing is almost unreadable and I have found a number of errors in them. I have recieved no response on having reported the bugs.
- Cells W2 - AB2 are the transmission gear inputs.
- Cell W3 contains the formula **=ROUND(V2*W2,2)**. This is the total gearing for each gear (gear x FD). Copy it to the range X3 - AB3. (Note: the values in W1 etc are the total gearing for the racing transmission's stock gears. I copy the values them there for future reference.)
- Row 4 just contains labels.
- Cell W5 is the Torque delivered to the rear wheel. It contains the formula **=W$3*$V5**. Copy this to the range W5 - AB29.
- Cell AC5 contains the derived Hp for each RPM increment. I'm not doing anything with this right now - it is validation of a bug I have found in the graphs or detail reporting, one. However the formula is **=(U5*V5)/5252** and it is copied to the range you see there.
- Now, to the shift points. This shows the entry RPM for the shifts 1 to 2, 2 to 3 etc. Cell X33 contains the forumla =(IF(W$2=0,0,X$2/W$2))*$U33 and it is copied to range X33 - AB40.
- The other part is not germaine to this discussion, but it is the velocity in mph for each gear at each RPM increment. The top part is a tire diameter calculator, the table is used for seeing if I can massage the gears to hit 60mph or 100mph sooner, and to track the top speed vs what is predicted and what actually happens. Stuff like that.

I have one of these spreadsheets for every car I build. I start with a template that has all the stuff in it. Use of the thing is pretty straight forward. When you start out the table is a fist full of zeros First you establish what rpm ranges you will be working in and input those values. The balance of the column will fill itself out. Next you enter your FD and Gear Ratios. Finally you input the torque values. I pull them from the graph initially. You will see two lines, a blue one with a smaller black one. The small black one is where the value actually is - the blue one is fat and is just used as an overview quick glance facilitator. You need to keep your head out and note the scale of the graph, it changes per car. It can be 800 or a 1000 RPM, the Y axis can be 100, 80, I've seen a 60 in Forza one. Don't assume, check it.

Here is a problem - I will mention it briefly. There are errors here. The Hp values are not what is posted in the Detail. The Hp and Torque values cross at 6000 rpm instead of 5252, and the peaks are in the wrong location. I haven't checked the telemetry yet, but with the modular construction of today's software, I suspect it won't be any better. I haven't gotten any response from my bug report...

To get the Torque from the telemetry, get on one end of the straight on King Cobra, put the car in 3rd and accellerate to the bottom of your range and then accellerate very slowly. Then from the telemetry screen on a replay, pause it at each RPM interval and read the engine torque at that point. I never could get consistent readings this way. But is okay for validation. Note: In the RPM column, the 5252 is input, and the following 5400.

The grey text above is more or less wrong. Read what it says at the other end of this link and do that instead...
http://forums.forzamotorsport.net/forums/permalink/370040/377254/ShowThread.aspx#377254

From the link:

> **Blooze:**
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> To get the Torque from the telemetry, get on one end of the straight on King Cobra, put the car in 3rd and accellerate to the bottom of your range and then accellerate very slowly. Then from the telemetry screen on a replay, pause it at each RPM interval and read the engine torque at that point. I never could get consistent readings this way. But is okay for validation. Note: In the RPM column, the 5252 is input, and the following 5400.

I think the problem with consistent readings is your method. Aren't dyno runs done at full throttle? If you are using part throttle acceleration you aren't using the engines full potential and it will skew the results low.

I played around with your spreadsheet last night. I went to the long straight on the Nürburgring selected 6th and did a full throttle acceleration down the straight. Played back the telemetry and recorded torque values. I repeated this in 5th (since I didn't redline that car in 6th). At low rpm (< 2500 rpm) the results were a little flaky, but for the rest of the range the torque values from both my runs were identical and looked like they agreed with the torque and hp curve for my engine shown in the engine upgrade screen. I spot checked the hp and speed on the telemetry and it looked like it agreed with the values calculated in the spreadsheet if you allow for rounding errors in the telemetry presentation.

I chose taller gears when recording a run for playback to give the slowest acceleration, making it easier to get values close to the target torque values from the playback of telemetry.

As your enter the torque values the rest of table fills out.

So now, what do you know. Look at the thing. Let's look at the Redline RPM in the Shiftpoint section. For this car it is 6300, so I hilighted the 6200 and 6400 rows. The car hasn't hit the rev limiter at 6400 and lower gears have oodles of torque so lets go with that. For the 1 - 2 change it tells me the resultant RPM will be 4407. Pretty close to 4400, we'll go with that. Now look above at the Torque table. In the first gear column I have made the torque at 6400 bold - 3478. In the second gear column I found 4400 RPM and made its torque bold 3187. There is more torque in 1st gear still, but I'm at the rev limiter, I have to shift. We are good to go here.

The case is the same 2 to 3 and 3 to 4. But something happend on the shift from 4th to 5th. If I shift at 6400 where the torque is 1443 and the entry point will be almost 5400. The torque at that point is

1470, more than what I left, good, but how long did I run at a lower torque value when a higher one was available? Let's check shifting at 6200 where the torque is 1509. Now the entry point is 1504. This is better. I will have more torque this way than shifting later. One could almost make an argument for shifting at 6000 here - sometimes I do. We have to make this same decision for the 5 to 6 shift too. And again, short shifting here will not hurt - just depends on what is going on.

After recording your values and picking your shift points drive it for awhile. Pretty soon you will get to wondering if you are leaving too much on the table in 2nd gear, maybe you can extend it a little and tighten the others up some (don't change 6th gear tho, it is derived from the terminal velocity and that will never change, at least while your car is configured as it is.) The advantage is that you can fiddle with the gear ratios and see what it does to your shift points, what the torque is when when you shift and what the speed is when you shift. It can save a bunch of time once it is put together - figuring out stuff by changing a few numbers instead of going around, and around, and around...

I hope this is some help.

Setting Up the Transmission Calculator

Okay, this is what the Calculator looks like when you first open it up.

Look at the bottom left where the tabs are. You will see two tabs, on **New**, and another **New(2).** If you don't want to always be cleaning the last car you worked on out of this thing, or going to get download another one because you deleted the wrong stuff, I recommend that you do this too. *Always* make a copy and work on that. In fact, I make a copy in another file. I have a workbook for each class. If I am working on a B car, I will copy the calculator to the BClass.wks and rename the tab to the car that I am working on. I wind up with a collection of setups that way and I don't step on the original.

The data you see there is bogus. The RPM column can only be turned into a row of zeros be setting the RPM Inc value to zero, and why do that. The gears are the stock gears that come with the racing transmission. The tire values are bogus and invite you to update them, your speeds will really suck if you don't.

Also, all of the places where you are required to input data are coloured light grey with hot pink text except for one, and that is the Torque Column, column B. Don't type stuff in anyplace else or you may be stepping on a formula.

So First, set the Tire Data and RPM ranges. Go the Details section of your car in my cars and scroll all the way to the bottom of the list. You will see your tires. Fill in the tire section now (Cells **K2, L2, M2**), while you are here. There is an explanation of which numbers are which there. Remember what car you are working with, get the rear tire values for a RWD, they may not be the same as the front tires.

A little further up you will see RPM values for Peak Torque, Peak Power and Red Line. Write these down if you need to, to remember them. Now go to the Dyno graph for your car. Be sure that you have the selector sitting on a part that you own. Look the curves over and take a SWAG at where you are going to need to run. What you are looking for is how far on the Low RPM side of the Torque curve you expect to get. With the Muscle cars, the only time you get that low is when you are in first gear and just taking off. For my car the peak Torque is 3400, the Power is 5200, and the Redline is 6300 and I know from having driven it I can hit 6400 without pinging the rev limiter. So what I want is the RPM column set so that 3400 to 6400 is somewhere in the middle of the column. Go to cell **A5** and try a few values until the peak torque and redline values are in the column. I chose 2400.

Now down a the bottom at cell A40, this is where you input the RPM levels that you will be shifting at. I have found that one increment past your decided max is good here. I said that was 6400, so I input 6600.

This is what the spreadsheet looks like with the RPMs in place and the Tire info entered. Notice that the speeds make more sense. Also, we have one known value. Max torque is at 3400 RPM. Max Torque for this car is 483, so entered that value. The rest of the row fills out when I do.

So, now the only thing left is to fill in the balance of the Torque values. I discussed that pretty well in the post above, I won't repeat it here. It is the one place where there are problems getting the data. That pissy little graph is not much help. Getting them from the Telemetry screen can take a while. I imagine we will end up discussing this part of it quite a bit as the days go by. There is already a pretty good suggestion below - see Tonka's post about getting the torque from Telemetry on the Nurburg... straight.

And this is what it looks like with all the values filled in. Ready to go to work. You can use any of Excel's devices, highlights, coloured text, bold, what ever to show parts of the table that you want to pay attention to. Put a pink hilight on the Redline Row for instance, using bold on your selected shift points - that sort of thing.

There really isn't much to filling it out - getting the torque values is a bit time consuming is all. The real work comes in making the decisions and testing them on the track. This just helps making the decisions not so shake and bake.

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