

SPROCKET TORQUE

Words: **Glen Williams**

This month, BRM's man in the race paddock, Glen Williams provides a guideline to gearing your trackday or race bike.

Most road racing classes in New Zealand allow you to change the gearing of your bike to help optimize its performance (acceleration and top speed) to suit a specific racetrack. There are a number of good reasons for this and a host of theories of what is best for your machine – here is an outline of the variables to help you make a call on what sprockets to fit.



It's All In The Way You Torque

The engine's torque and power delivery characteristics will have a large bearing on your choice of preferred gearing for a particular track. Some engines have a wide spread of torque (e.g. V-twins), while others can be more peaky and deliver maximum torque/power closer to the top of their rev range, i.e. two-strokes and some multi-cylinder four-strokes with crazy cams etc.

As a rider you need to identify where the optimum peak torque of your engine is. Sometimes this can be as simple as running your bike on a dyno and seeing where the peak torque is delivered on the readout, but bum on the seat feedback is also pretty accurate. Once you know where the motor is strongest and 'pulling hardest', you can then identify the critical corners at each track where you want to optimise the bike's power delivery. For instance a corner leading onto a long straight should ideally have the bike exiting at near to its ideal peak torque. Running gearing that has the engine 'bogging down' or 'peaking out' the engine, will waste a great deal of potential 'accumulative acceleration' for the full length of said straight. In most instances the standard road gearing on a motorcycle will allow its top speed just below the maximum power figure when in top gear.

Up, Down – Round & Around

Most of us do not have the luxury of changing internal gearbox ratios (like on a GP bike) at the track – which ultimately is the best solution to matching the bike's gearing to the track. But by changing front and rear sprockets we can get the set up at least a little closer.

If the track has quite a few turns – it is often worthwhile considering a gearing option that minimizes the amount of total gear changes that you need to make on any given lap. On tight sinewy tracks with medium length straights you may find that gearing your bike to achieve redline revs in top gear for the straight is a mistake. Often by choosing taller gearing you will save yourself a number of up changes and down changes on every lap and this can often translate into a faster overall laptime. Each gear change you make costs you time, and can unbalance the bike. You need to trust the stopwatch in these sorts of situations – as sometimes what 'feels quick' may in-fact not be so.

Gear Up For The Weather

Another reason to change your bike's gearing can be as simple as adjusting the machine for the weather. For instance a strong headwind on a long straight will likely require that you fit shorter gearing (smaller front sprocket or larger rear) effectively making it easier for the motor to drive the bike into the headwind. Conversely if you have a tail wind you may gear the bike 'taller' (larger on the front or smaller on the back) so as to stop the engine from over-revving in top gear and also to maximise your potential top speed.

Wet weather can also affect your gearing choice. With less corner speed and corner exit speed in the wet – it is not uncommon to run slightly shorter gearing on the bike to assist with keeping the motor in the strongest part of its power delivery. Don't go too far with this though as the last thing you want in the wet is overly short gearing that delivers sudden or aggressive acceleration to the rear wheel.

Geometrically Speaking

Another consideration for gearing choices is how it will affect your machines wheelbase. For instance, a gearing choice of 14-tooth front and 42-tooth rear, has the same ratio as say a 16T front / 48T rear (both are a ratio of 3.00), however your 16/48 choice may well shorten the wheelbase of the bike by up to 30mm. This side effect is worth remembering as you experiment with

different options.

Making gearing changes for wheelbase purposes alone is relatively common – but it is usually only done after you have identified your optimal gearing ratio and have then moved onto working on the bikes geometry set-up as a separate issue.

Another geometry issue to consider with gearing changes is a thing called 'chain pull' - this is an expression used with respect to how the relative angle of the top of the chain/swingarm and sprocket sizes can 'pull' the suspension in one direction or the other. Talk with your suspension specialist to ascertain the



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details of chain pull or 'anti-squat' effect on your machine as it can be a bit of a dark science.

Mechanical Shenanigans

When changing your front or rear sprockets (a relatively simple job) – be sure to double-check all parts of your work as you go. I have seen the consequences of riders leaving front or rear sprocket bolts loose or not locked off. Also be aware that changing to an overly small front sprocket may rob you of power, as the chain has to 'curl around' it in a tight loop. Plus a too small front or rear sprocket can lower the chain down to rub on your swingarm and potentially wear into it.

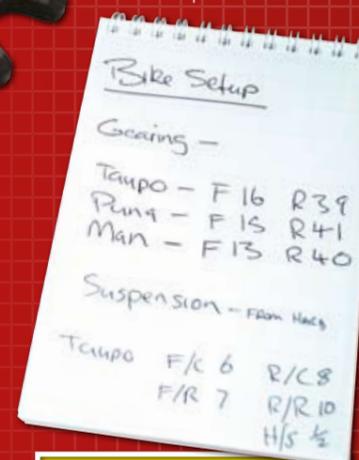
Tyres And Gear Effect

The rear tyre has a surprising effect

on gearing. Tyre gearing effect is most noticeable when you are leaning the bike over through a corner, the smaller rolling diameter of the outer edge of the tyre will see the bike picking up revs. Also noticeable is when you might try different brands of tyres only to realise that the rolling diameter of the tyre has changed your gearing slightly. A slightly larger rolling diameter will often require you to fit a slightly larger rear sprocket and vice-versa to maintain your desired optimum gearing ratio.

Keep Notes

Remember to keep a note of your gearing choices made at the various tracks you visit and also write down the weather and wind conditions/direction on the day. The next time you visit the same circuit you may find that differing conditions will require you to subtly modify your gearing choices. If (like me) – you are getting old and forgetful, then notes help in this respect to.....



THE LONG & THE SHORT OF IT

Smaller on the front - larger on the back can be often referred to as: 'Shorter', 'Lower', or 'Under-geared'.

Larger on the front / smaller on the back can be often referred to as: 'Taller', 'Longer', 'Higher' or 'Over geared'.

RATIO CALCULATOR

F = Front Sprocket, R = Rear Sprocket

	13F	14F	15F	16F	17F
38R	2.92	2.71	2.53	2.38	2.24
39R	3.00	2.79	2.60	2.44	2.29
40R	3.08	2.86	2.67	2.50	2.35
41R	3.15	2.93	2.73	2.56	2.41
42R	3.23	3.00	2.80	2.63	2.47
43R	3.31	3.07	2.87	2.69	2.53
44R	3.38	3.14	2.93	2.75	2.59
45R	3.46	3.21	3.00	2.81	2.65
46R	3.54	3.29	3.07	2.88	2.71
47R	3.62	3.36	3.13	2.94	2.76
48R	3.69	3.43	3.20	3.00	2.82
49R	3.77	3.50	3.27	3.06	2.88
50R	3.85	3.57	3.33	3.13	2.94

