TEAM Benwell

Introduction

One of the major influences on any bike set up is the location of the c of g. it is what governs weight transfer during braking and acceleration as well as the angle of lean required when travelling through a turn.

Although at this early stage in motorcycle development it is unclear what is a good position and what is a bad one it would clearly help to understand how its position effects bike handling.

Unfortunately it is not easy to locate as it is fixed in space with three possible co-ordinates. A front back position (X), up down (Y) and side to side (Z). However it is possible with just a set of digit scales a ruler and some packing pieces. I will explain

Calculation

Firstly we need a point of reference and I decided that the most sensible point is the contact patch of the front tyre. We then consider each component individually and for no other reason we will start with the easiest first.

Note through out this the units you chose to work in are not important only that you stick to the same through out. For example I chose to do all lengths in mm's and all weights in grams.

Z Component

We can assume that after you best efforts when building the bike that it is located on the centre line of the bike and thus the (Z) component we will consider as Zero and thus ignore.

X Component

Next the (X) component. (the position horizontally between the front and rear wheels. To locate this measure the bikes wheel base at normal ride height (Note this changes when the suspension is compressed) and obtain two weight measurements. The total weight of the bike and the total amount of weight on the rear wheel only. When measuring this it is important that both wheels are at the same height so use some of your packing to raise the front up to the same height as the scales.

The calculation is then: -

$$\frac{\text{(Rear Wheel weight) x (Wheel base)}}{\text{(Total Weight)}}$$

This gives you the location as a measurement back from the front tyres contact patch.

Y Component

This is the hardest one but here is the simplest way I've found to obtain a relatively accurate measurement.

This time you will need to obtain the weight of the rear wheel as before but also its weight when raised up a specific height. Use your packing to raise the rear wheel (and the scales obviously) so that it is exactly 1/3 of the wheel base high. For example my bike's wheel base is 295mm thus I had to raise the rear wheel exactly 98.3mm. Clearly not easy but get this as accurate as you can.

The final measurement you need is the average radius of the tyres on the bike. With the worn Nuova wets that I used this was 62.5mm for the rear and 55mm for the front. Giving an average of 58.75mm.

The final calculation is then: -

$$\text{C of g Height} = \frac{2.828 \times WB \times (WW1 - WW2)}{TW} + Rad$$

WB - Wheel base
WW1 - Weight on rear wheel normal
WW2 - Weight on rear wheel raised
TW - Total bike weight
Rad - Average radius of wheels.

For my bike that is

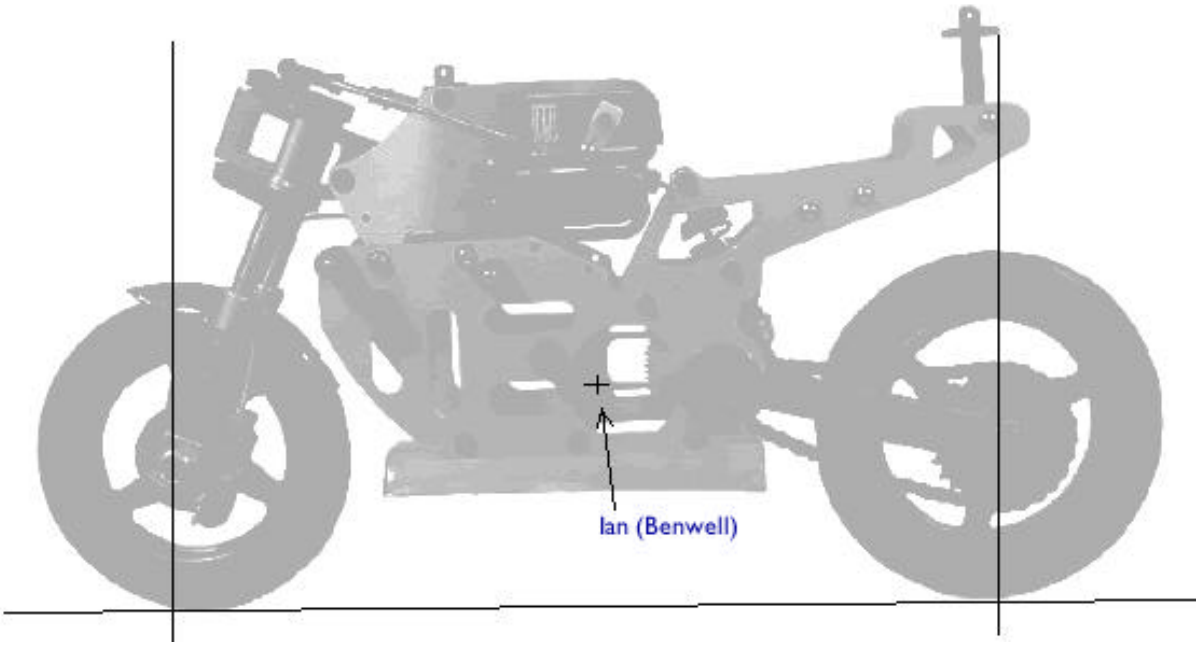
$$\frac{2.828 \times 295 \times (994 - 942)}{2000} + 58.75 = 80.44\text{mm}$$

Therefore it is 80.44mm vertical from the ground.

Conclusions.

I expected my c of g to be fairly central but didn't expect it to be so low. My bike is particularly good under power and braking but doesn't carry speed through the corners as well as others I have raced against.

If everyone that reads this can calculate there own c of g position with a brief explanation of what they feel there bikes strengths and weaknesses are we will happily publish the findings. Perhaps between us we can forward bike design. It would be in everyone's interest to make bikes more ride able and c of g is a small but significant factor in this.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