

HND Motorsport Engineering and HND Automotive Engineering Motorsport /Vehicle Technology B

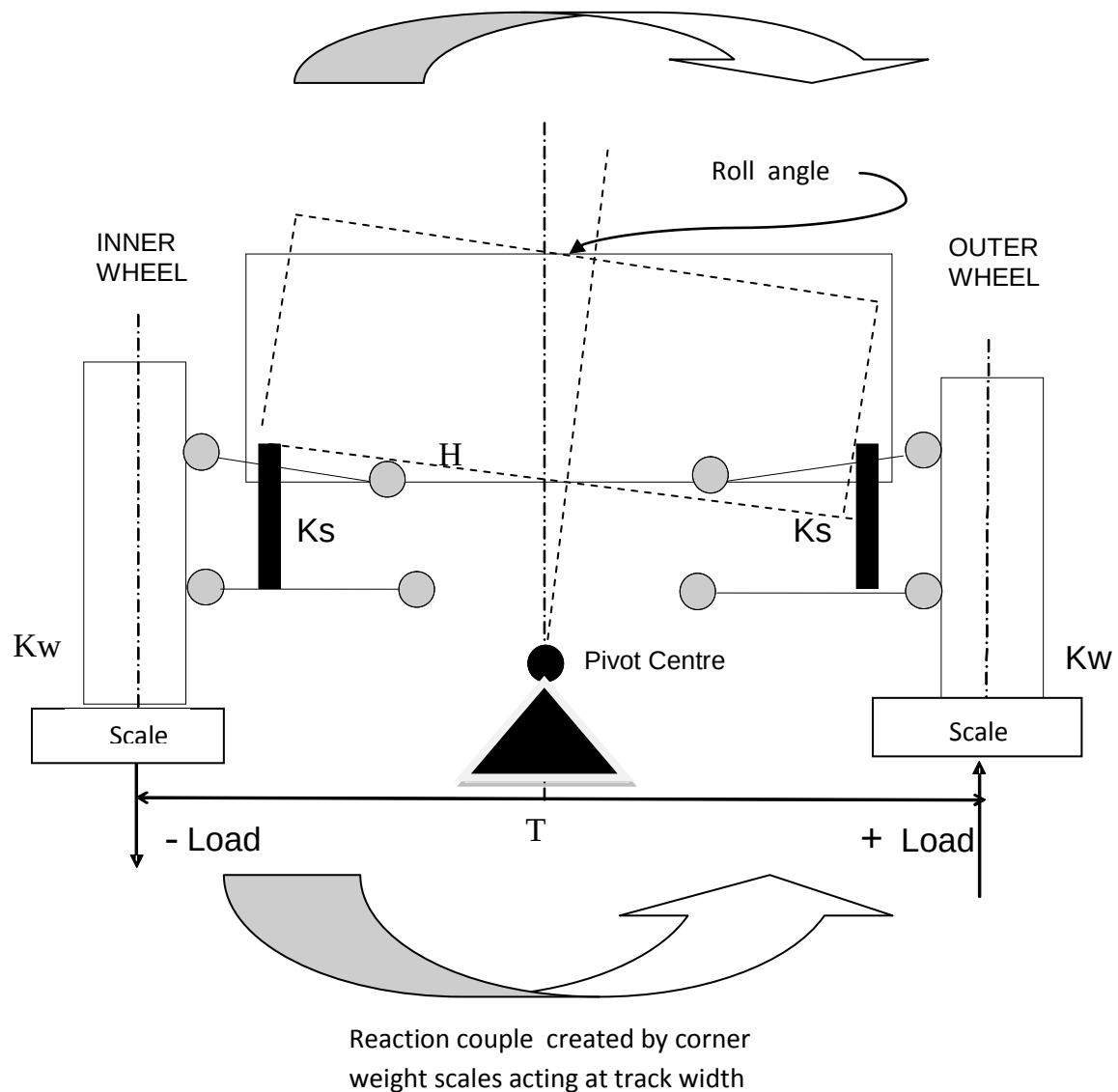
Twist rig test

To take advantage of the fact that the LocoBlade is on the twist rig at the moment we can carry out the following test. This will demonstrate how roll stiffness can be measured practically as well as being calculated from vehicle suspension data.

The results obtained will form a significant part of Assignment 2 so take care with taking them and and record them accurately.

Theory behind the test

Overturning moment equivalent to car cornering to the left is provided by jack acting on lever at other end of car. This is reacted by the couple at the front of the car created by the two wheels



Initial Measurements

Front

Front Track (Plate to plate) 1515 mm

Front Spring rate 248lb/inch or 43.53758 N/mm

Collect the required data to carry out the calculations including:

1. Front motion ratio
2. Front suspension points to calculate motion ratio

Front Roll Stiffness

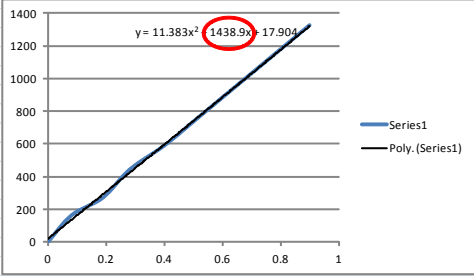
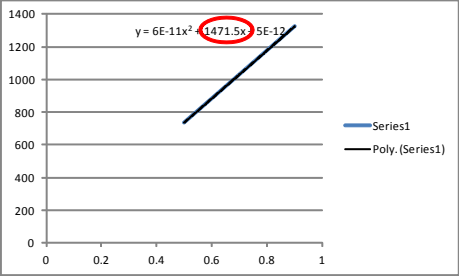
1. With the car mounted on the chassis pivots ensure the front wheels are pre-loaded to around 50kg on the front scales by winding the scale mounts up .
2. Zero the scales
3. Apply a load to the lever at the rear of the car and note the load on each front scale.
4. Add the two values ignoring the sign of the value (one will be +ve and the other –ve.
5. Divide by 2 to find average wheel load
6. Multiply this average load by track to find couple being reacted by the front wheels.
7. Note and record the angle of the chassis at the front suspension and rear bulkhead
8. Divide roll angle by the calculated couple to give the roll stiffness of the front suspension
9. Calculate the theoretical roll stiffness of the front suspension using the equation developed in class:

$$\text{eg } K_{\phi f} = \frac{(I_f^2 \times K_{wfl})}{2}$$

10. Repeat the exercise for a number of loadings (but stop before you either destroy the chassis or ruin the scales!) Look for consistent results over a number of readings rather than an average value across the whole range of loads. The final value of roll stiffness should be consistent for a number of readings. Low load values are likely to vary significantly as friction and clearances create larger errors.

Rather than doing the calculation for each result you will find it much easier to create a spreadsheet to work out the results required. Plotting the results is an even better way to get a consistent result. (See the screen dump on the next page)

Example Spreadsheet to calculate roll stiffness form twist rig results

Front Track	1.5				
Example Front Measurements					
Front Right Wheel Scale	Front Left Whee Scale	Mean wheel load	Angle of front chassis	Front Roll moment	Calculated Roll Stiffness
kg	kg	N	deg	Nm	Nm/deg
Record as +ve value	Record as +ve value	$9.81 * (\text{Front Right} + \text{Front Left}) / 2$		Front Track * Mean wheel load	Change in Moment / Change in angle
0	0	0	0	0	
10	12	107.91	0.08	161.865	2023.3
20	17	181.485	0.19	272.2275	1003.3
30	30	294.3	0.28	441.45	1880.3
40	40	392.4	0.4	588.6	1226.3
50	50	490.5	0.5	735.75	1471.5
60	60	588.6	0.6	882.9	1471.5
70	70	686.7	0.7	1030.05	1471.5
80	80	784.8	0.8	1177.2	1471.5
90	90	882.9	0.9	1324.35	1471.5
Alternative method to obtain stiffness by plotting results and looking at linear gradient of trendline					
		All results plotted			
		More consistent results only plotted			