

BEng Motorsport Engineering and Design

BEng Automotive Engineering

Competition Vehicle Dynamics

Vehicle Dynamics

Non- assessed assignment to determine longitudinal load transfer and road tyre friction coefficient

Thursday 14th March 2013

Aims
This assignment will give you the opportunity to apply the work covered on analysing the load transfer characteristics of a car under steady state longitudinal accelerations. This can be used to determine road tyre coefficient of friction.
Procedure
Brief 1. You have been divided into four working groups ,and each working group will need to design the detailed test procedure and the calculations required to achieve the aims of the assignment. Groups A and B will attend in the morning and Groups C and D in the afternoon Each working group will work independently at the circuit having approximately 1.5 hrs to undertake their test. 2. The minibus will leave the university at 9.00 for Groups A and B and at 12.00 for Groups C and D . 3. Group A and C will look at front tyre behaviour and Groups C and D will look at rear tyre behaviour. Tasks 1. Determine the maximum rate of deceleration achievable by the car with four wheel braking and hence determine a mean value for μ for the car. 2. Determine the maximum rate of deceleration achievable by the car with two wheel braking and hence determine a value for μ for the pair of wheels being investigated by your group.

Prior to the Test

To make the most of this exercise it is worth preparing for it by creating a spreadsheet to do the necessary calculations (finding weight transfer, resulting wheel load, longitudinal braking force and hence μ_t) so that as soon as a valid rate of deceleration is obtained from the data a value for coefficient of friction can be calculated.

Test procedure and data analysis at Pembrey

1. Top up fuel tank outside workshop
2. Measure car in workshop including
 - ride height,
 - individual wheel loads
 - tyre pressures
 - air and track temperature
 - fuel level
3. Set up data logging laptop-and ensure download path is correct in Pi Delta.software.
4. Send car out for first test run with all four wheels braking.
5. The car will be braked from around 45 kph for a number of braking events. Tyre surface temperature will be monitored and so the influence of tyre temperature on μ_t can be investigated at the same time.
6. When the test run is completed use the data obtained to determine the average road tyre coefficient of friction μ_t for the whole car. Demonstrate that for 4 wheel braking μ is simply a/g
7. Send the car out again to repeat the test but now with the two wheels you will be investigating being braked.
8. When that test is completed again use the data obtained to determine the average road tyre coefficient of friction μ_t for the pair of braked tyres investigated

Questions to answer when analysing the results

1. Look at characteristics of braking deceleration profile. How does it build up and maintain during the braking event?
2. Look at **peak** decelerations for each braking event and **mean** deceleration for each braking event – which is the most valid for determining a coefficient of friction for a tyre?
3. What is the significance of the deceleration profile during each braking event?
4. Does the tyre surface temperature affect the peak and mean deceleration achieved during each braking event ?
5. Is there a difference between the average μ_t for the car with all wheel braking and average μ_t for the axle with just two wheels braking ? What explanation could there be for such a difference?
6. Is there a need to include an allowance for lateral acceleration when rear only braking is being undertaken?

Group A

1	Bagnall	Sam
2	Ben	Jeffries
3	Castle	Joel
4	Chu	Alex
5	Davies	Carwyn
6	Dryer	Keegan
7	Foley	Adam John
8	Francis	Andrew
9	Hayes	Lawrence John
10	Hooper	Samuel

Group B

11	Jones	Daniel Alexander
12	Joseph	Samuel Clement John
13	Lycett	Steven
14	Perry	William
15	Pidgeon	Daniel
16	Pollard	Ross
17	Rees	Christopher James
18	Smart	Calum
19	Varghese	Titto
20	Williams	Alex

Group C

1	Austin-Morgan	Dominic
2	Catto	Dale
3	Chetri	Rabindra
4	Coughlan	James
5	Gueriot	Quentin
6	Jenner	Oliver
7	Jones	Christopher
8	Mason	Gavin

Group D

9	Matijuk	Taras Anton Sasha
10	Pelletier	Florent
11	Phillips	Matthew
12	Shao	Yikai
13	Till	Christopher
14	Touze	Maxime
15	Wilkinson-Sedgwick	Jack Michael
16	William-Jones	Adam

