SolidStatRacing IR Temperature Sensors
F3000 Test – Snetterton

Front Plank Temperature Data Report

One way to increase the downforce level on a racecar is to reduce the pressure of the air passing under the car by lowering the car closer to the ground. In order to regulate this, the FIA deem it mandatory for all F3000 cars to run a wooden plan along the length of the underside of the floor. This plank must be of a certain thickness (9mm) at the end of each session for the car to pass any scrutineering checks.
In the past the most effective way of knowing if the car is 'touching', where the plank makes contact with the track surface, is by lifting the car in the pits and seeing if the paint has worn away and if the plank is hot to the touch.
In order to be able to monitor plank temperature on the data, we have mounted an IR sensor between the chassis tub at the front – where it angles up under the driver's knees – and the plank. The sensor receives emissions form the reverse side of the plank and we have tested it recently to see if the temperature transfer from the contact surface, through the plank is rapid enough to give us reasonable results.
Following in this report are two plots of plank temperature data from the recent Snetterton test in England. The first shows an overview of the entire lap and the second a closer view of the back straight.

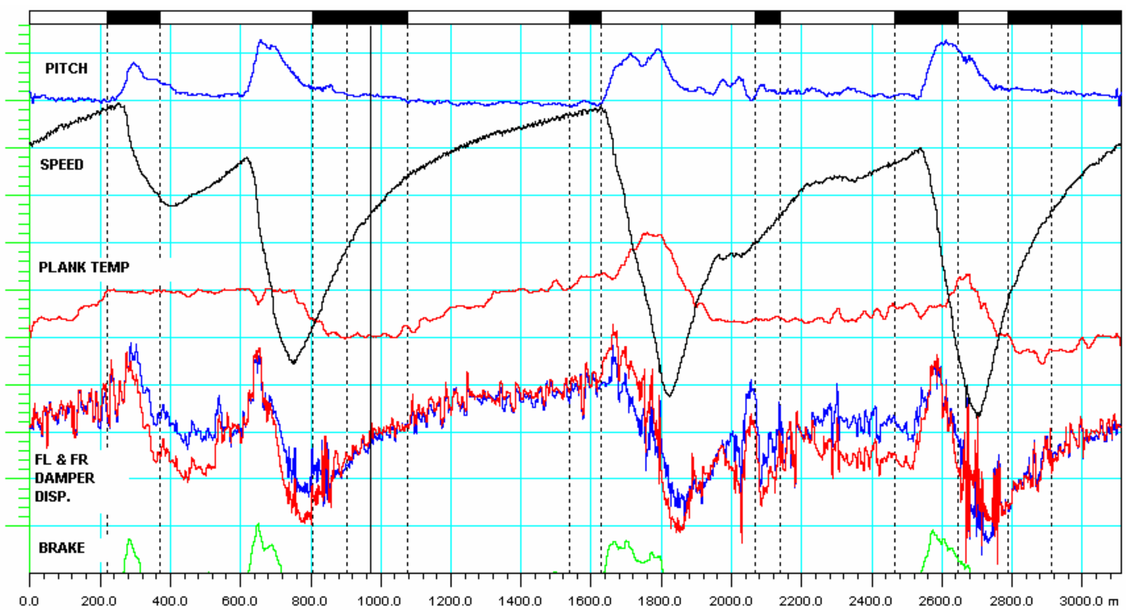
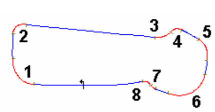


FIG.1 Overview of complete lap

By analysing the data shown in FIG. 1 above, in conjunction with the track map below, the plank temperature data can be split into a number of distinct sections.



- For the first 200 metres, from the start of the lap until the braking for the first corner, the plank temperature is rising as the car gets lower to the ground – either continually touching, or more likely bouncing with frequent contact – as the downforce increases with speed and the car's springs and bump rubbers are compressed.

- The plank temperature stays constant for the next 500m (Turns 1 & 2) as the car is cornering at a lower speed than that attained on the straight and the aerodynamic load is not so great – resulting in a higher ride height.
- At 800m the car begins to accelerate down the main straight (see FIG. 2 below). Whilst the car is accelerating the car assumes a pitch-up attitude with the rear squatting down. During this phase the plank temperature increases steadily as the whole plank – starting from the rear – is in contact with the ground. Although the temperature sensor is mounted at the front, we are able to see an increase in the plank temperature caused, initially at least, by the rear of the plank making contact with the ground, as there is a significant level of heat transfer along the length of the plank.

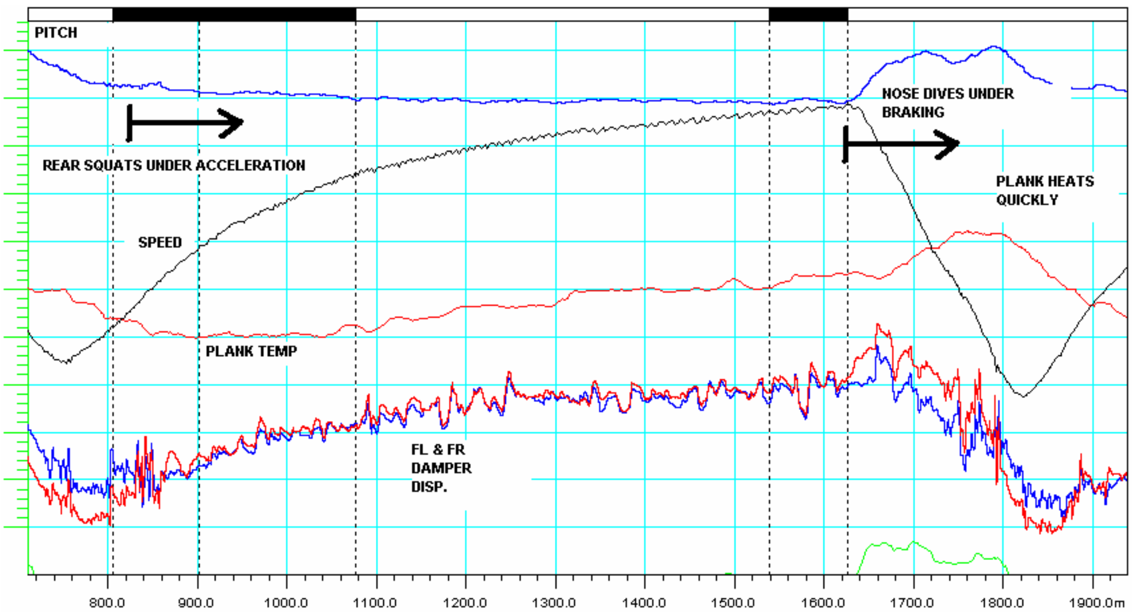


FIG. 2 Close-up view of back straight between Turns 2 & 3

- At 1250m, approximately half way along the straight the car's acceleration is diminishing and the car settles close to its maximum spring and bump rubber deflection. The temperature continues to rise, as the plank is either in continual or frequent contact with the track surface.
- At the end of the straight (approx.1620m) the car dives at the front as the brakes are applied. This is the part of the track where the car experiences the most vertical load through the front of the car, firstly due to the braking force transferring the vehicle weight towards the front (resulting in a nose-down pitch) and also due to the high speed developing a large amount of downforce. The resulting plank temperature is the highest of the lap, demonstrating that the forward part of the plank makes heavy contact with the track surface as the brakes are applied.
- Over the next 800m (FIG. 1) the car completes Turns 4, 5 & 6 at a lower speed and therefore a higher ride-height. The plank initially cools and then maintains a constant temperature until the approach to Turn 7 where it increases slightly due to some touching at high speed before the braking point. Again, the temperature rises more abruptly in the braking zone as the car pitches nose-down.

From this data and the subsequent analysis described above, we are able to make more informed decisions about the static and dynamic ride heights of the car. In the future we will also be looking to fit a similar sensor to the rear section of plank so we can make better judgements as to which end of the car is making first contact with the track surface.

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