Note 30

Increased Road Grip

Increased road grip has been generated since 1906 in 3 ways:-

(1.). Early road surfaces rapidly became loose on corners during races – the 1921 French Grand Prix was characterised by the winner, Jimmy Murphy, as "*a rock-throwing competition!*". From the mid-'20s asphalt and tar were used generally to bind the surfaces, although melting in excessive heat could still cause track problems as late as the 1959 French GP.

(2.). Tyre grip has improved steadily.

In 1954 Mercedes calculated cornering speeds on an assumption of a maximum friction coefficient, (Side load/Down load), of 1. Measurements justified this choice.

From 1961 high-hysteresis tread compounds were introduced to raise friction coefficient

Over 1964 – 1968 particularly there was a large increase in tyre (Width/Diameter) ratio to reduce slip angle at the limit of adhesion by providing a more effective contact patch shape, the (Lateral width/Circumferential length) ratio being raised. [This the tyre makers called "L*ower aspect Ratio*" by reference to (Radial Depth/Width) but which aerodynamicists by analogy with wing performance, Lift versus Incidence, would call "*Higher Aspect Ratio*"!]

Slick, i.e. pattern-less, tyres which produced a further reduction in contact patch distortion came into GP use for dry conditions in 1971. US Dragsters had used them, for acceleration benefit of course, since the early 1960s.

Radial-ply carcases, again to reduce contact patch distortion, began to supersede cross-ply from mid-1977 when Michelin pioneered them for racing (on the new Renault TurboCharged car) as they had done for road use some 15 years earlier. They were first used on a Championship-winning car by Ferrari in 1979.

Working in the *opposite* direction to improvement in road grip, rules were introduced in 1998 (which amplified earlier tyre width restrictions) to require *circumferential* grooves in treads to *promote* contact patch distortion and so cut cornering speeds. The details were 3 front tyre grooves and 4 rear. However, "*Tyre Wars*" between Goodyear and Bridgestone with competing tread compounds and carcase construction quickly negated the intended speed reduction. The grooving was changed in 1999 to 4 grooves all round.

Ref. (987) shows that in 2000 Bridgestone tyres for Ferrari were capable of a maximum friction coefficient of about 2.

(3.).Aerodynamics were harnessed deliberately to increase downforce for GP road-racing in 1968 by adding "*upside-down wings*". Ferrari led the way.

Lotus in 1977 pioneered the use of under-body venturis, made really effective by track-touching sliding skirts which prevented air inflow at the sides, to gain further downforce.

Both aerofoils since 1968 and venturis since 1977 have had many and various rules applied to limit their effect, especially the banning of skirts, but both are still present to contribute very largely to road grip.

The magnitude of the improvements in road grip over the review period can be shown in braking performance – perhaps only 1/4 g for rear-wheel-only drum brakes on loose surfaces in 1906 to 4 g from 350 kph for the Ferrari with Carbon-fibre-reinforced-carbon discs/ carbon pads at Monza in 2000 (987).