

**Note 131B**

**1.5 litre B-type ERA Lap Speeds – CONTINUED**



Note 131 described the longevity of the B-type ERA racing career as an opportunity to use its performance over a wide variety of circuits as a way of correlating Lap Speeds (LS, MPH) with their geometry. From previous Multi-variable Regression Analysis (MRA) work on the 2013 Grand Prix season the relation used was:-

$$LS \text{ proportional to } (1609 \times L)^{0.4} / (T)^{0.3}$$

Where 1609 converts L ( Lap length) in miles to metres;

and T = Total degrees turning in the lap, Left + Right.

The RHS of the relation was named Track Factor, TF.

This check produced the rather poor result:-

$$LS = 28.7. (TF)^{0.69}$$

with the co-efficient of correlation of R<sup>2</sup> = 0.76.

This could have been re-cast as:-

$$LS = 28.7.(1609 \times L)^{0.276} / (T)^{0.207}$$

**Factor of difficulty**

The author felt that visitors were entitled to some further work on the subject of relating car performance to circuit characteristics.

Note 131 concluded that, while the angles comprising T were not doubtful, there needed to be some “Factor of Difficulty” applied to their values to improve the correlation with LS. To do that required some method laid down to minimise subjective judgement. Given below is the method used next, admitting that the angle multiplications were purely arbitrary to see whether the result seemed sensible.

**Method for determining Modified Turning Angle (TM)**

Given the basic details measured for total turning (T), with Left and Right angles identified and with the difference checked as 360<sup>0</sup>, the Modified Turning Angles are determined as follows, by multiplying each angle by a Factor of Difficulty (FOD).

- | <u>Measured Turning Angle</u>   | <u>FOD multiplication</u> |   |
|---------------------------------|---------------------------|---|
| • <b>40<sup>0</sup> or less</b> | Measured angle x 0        | Treated as “Non-friction-limited”,              |
|                                 |                           | by the car path radiused within the road width. |

- **Between 80<sup>0</sup> and 100<sup>0</sup>**

Sharp corner meaning that the car path is radiused only in road width:-

Measured angle x 2

Radiused corner

Take angle as measured

- **Beteen 150<sup>0</sup> and 180<sup>0</sup>**

Sharp Hairpin (as above)

Measured angle x 3

Radiused

Take angle as measured

- **Chicane**

Measured angles x 1.5

The data for the B-type ERA with the values of TM is given on P.2. A MRA was made with input of L and TM and after some trial and error a new Track Factor TF4 was adopted. This was:-

$$TF4 = (1609 \times L)^{0.22} / (TM)^{0.26} .$$

<b>B-type ERA</b>							
<b>Year</b>	<b>Driver</b>	<b>Circuit</b>	<b>L Miles</b>	<b>T<sup>0</sup></b>	<b>TM<sup>0</sup></b>	<b>LS-MPH</b>	<b>TF4</b>
1935	Raymond Mays	Nurburgring	14.17	3840	4176	71.3	1041
1935	Raymond Mays	Dieppe	5.005	760	1111	79.3	1.168
1936	Lord Howe	Monaco	1.958	1494	2028	56.8	0.812
1936	Marcel Lehoux	Douglas	4.000	826	1097	71.2	1.115
1936	Pat Fairfield	Donington	2.551	916	1013	72.9	1.031
1936	B. Bira	Albi	5.531	617	893	95.3	1.264
1936	Pat Fairfield	Peronne	6.06	560	922	88.7	1.279
1936	Pat Fairfield	Berne	4.524	920	654	90.5*	1.311
1936	B. Bira	Cork	6.088	754	1075	92.08	1.230
1936	B. Bira	Limerick	2.76	840	1177**	73.34	1.080
1937	B. Bira	Turin	1.818	1242	2335	56.9	0.771
1938	Tony Rolt	Leinster	5.917	1454	1550	83.53	1.111
1938	Arthur Dobson	Donington '37	3.125	936	1012	77.8	1.079
1939	B. Bira	Crystal Palace	2.000	1332	1540	60.2	0.877
1946	B. Bira	Geneva	1.855	604	1095	66.8	0.942
1948	Cuthbert Harrison	Monza	3.915	490	477	96.5	1.379
1949	Bob Gerard	Douglas '37	3.87	826	881	73.9	1.172
1950	Bob Gerard	Jersey	3.199	520	650	92.6	1.217

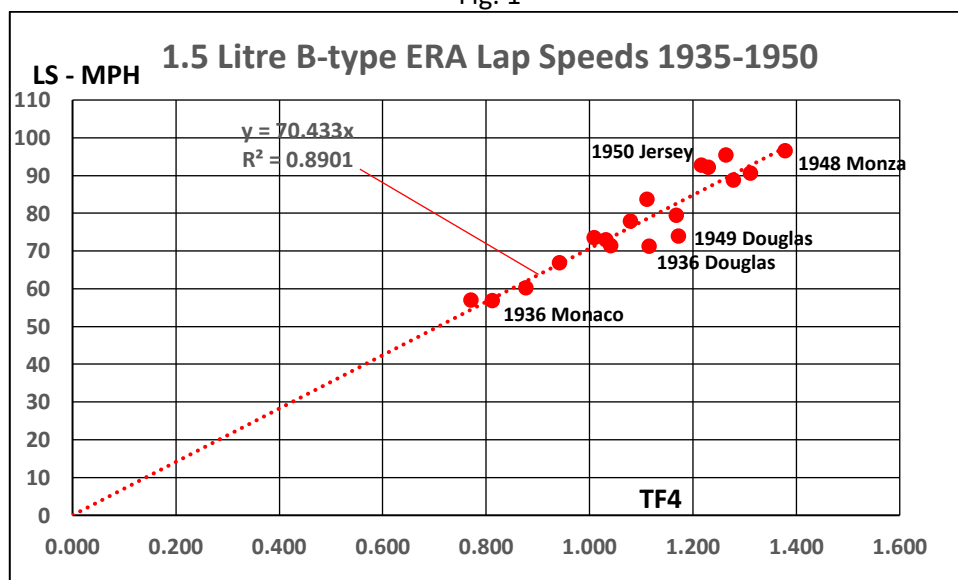
Only the highest B-type values of LS for each circuit are taken here.

\*Correcting LS from 92.96 in Note 131 from DASO 1219 (see Refs. below) to the figure from DASO 1221. An advance of nearly 6 MPH over Dick Seaman's 1935 lap was just not possible. There must have been a timing error.

\*\*Including 2 chicanes not shown on the available plan but described in reports and seen on a U-tube of a contemporary newsreel.

Fig. 1 gives the result of plotting LS versus TF4.

Fig. 1



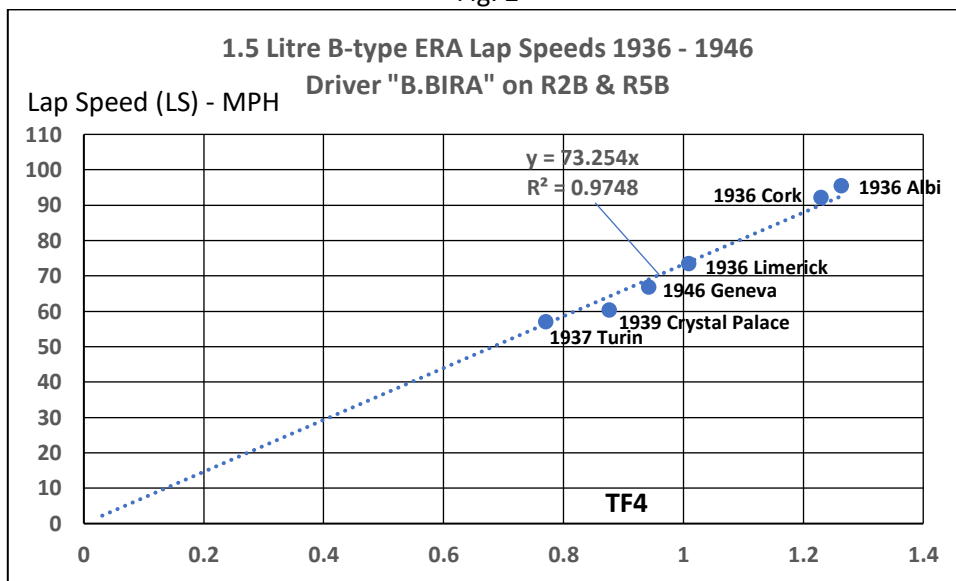
Clearly, Fig.1 is a large improvement on Note 131, since the co-efficient of correlation has increased from 0.76 to 0.89. A result which aligns 1936 Monaco (56.8 MPH) with 1948 Monza (96.5 MPH) cannot be too bad! The scatter is still too high, although the poor result for Douglas 1936 is easily explained: DASO 1221 describes the back stretch of that circuit as follows: “ *very difficult abounded with sharp and blind corners high banks and hedges on both sides* ”. The just-as-poor result for Douglas 1949 is curious. The circuit, first chosen in 1937, was described then by *The Motor* as a “100% improvement” (over 1936), with a flat-out dash along the nearly mile long promenade, but DASO 1222 says that there followed “*a most difficult climbing section with plenty of zigzag and hairpin bends*” which must explain the low speed. These points are made to illustrate the problem of only being able to use published plans. The high Jersey speed can only be put down to the width of the roads used, easing the apparent two hairpins.

At any rate, the arbitrary FOD multiplications do not seem to be wildly out.

The correlation for individual drivers

Fig. 1 includes 18 laps by 9 drivers. To eliminate scatter from this, the career of “B. Bira” has been examined separately, since this very-talented driver with a well-managed team accomplished 6 of these laps. The result is shown on Fig. 2.

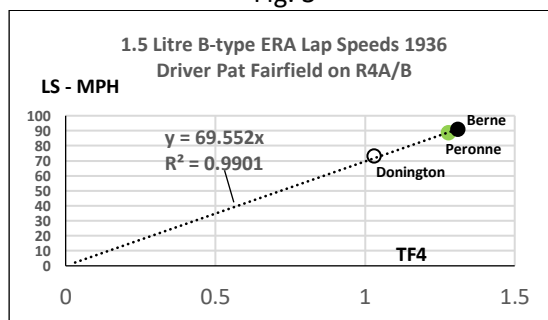
Fig. 2



For this single driver over a wide range of lap speeds, the correlation co-efficient has reached the remarkable value of 0.975.

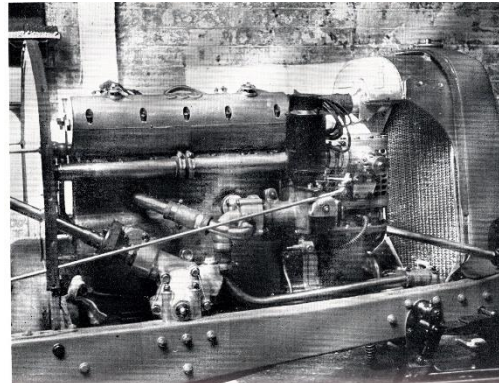
Pat Fairfield in 1936 produced 3 of the laps tabled. His individual performance is even better correlated by TF4, as shown on Fig. 3\*

Fig. 3

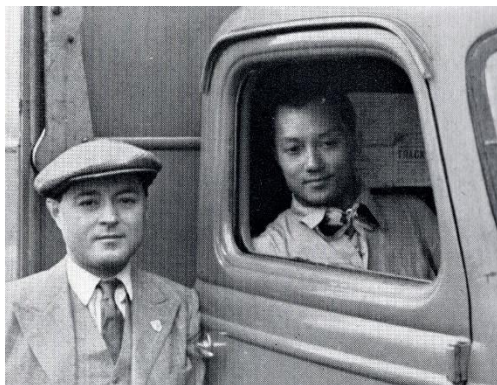


[\*The author has chosen marker colours appropriate to the drivers in Figs 2 & 3: blue for Bira, of course; white for Fairfield as an independent at Donington, green for his incorporation into the works team for Peronne and black for Berne when the works decided that green was unlucky. His R4A/B may not actually have been re-painted in team colours.]

Engine of ERA R2B "Romulus".



DASO 1223



DASO 1223

The White Mouse équipe, 1935 - 1948.  
 Manager Prince Chula of Siam and his cousin and driver "B. Bira". As an honorary member of the British Racing Drivers' Club Bira was eligible to compete for their Gold Star. He won it in 1936, 1937 and 1938, ahead of Dick Seaman, Raymond Mays and Arthur Dobson, respectively.

Pat Fairfield  
 1907 - 1937



PA Images

### Conclusion

After a revised MRA specific to the B-type ERA, adopting for the circuit curves the Factors of Difficulty tabled above and looking at the performance of individual drivers, a good correlation has been obtained for lap speed versus modified geometry.

### References

- DASO 1219 [www.kolumbus.f1/leif.snellman](http://www.kolumbus.f1/leif.snellman) The Golden Era of GP racing, 1926 – 1940.  
 DASO 1221 Road Racing 1936 Prince Chula of Siam..Foulis 1972 ed.  
 DASO 1223 Blue and Yellow Prince Chula of Siam Foulis 1947.