**Executive Summary of AirDensityDrive: F1 Power & Top-Speed Analysis**

**Aim**

Demonstrate the impact of air density on engine power output, drag force and top speed for a Formula 1 vehicle for current and upcoming regulations.

**Scope**

All 24 tracks from F1 calendar

Ambient conditions at each track

Engine model: Choked air flow conditons

Drag & Rolling-Resistance Physics

**Methodology**

1. Data Collection: Elevation & Average track temperature per circuit
2. Density & Flow Model: Barometric formula + choked flow assumption
3. Power Calculation: ICE LHV x eta combustion +MGU-K contribution
4. Top Speed Solver: Numerical root-finding(fzero) to balance Pdrag + Prr = Ptotal
5. Validation: Comparison with FIA speed data (not all data was available)

**Key Results**

As it can be seen from *Figure 1*, apart from Mexico City, Sao Paulo and Las Vegas, air density ranges around 1.1 to 1.2 kg/m3 and therefore expected power output is also quite similar which can be seen from *Figure 2*. On the other hand, at these 3 tracks in maximum flow conditions maximum engine power drops up to **X** and maximum total available power drops up to 19% than the average. From power stand point, these cars should be slower. However, as it can be clearly seen from *Figure 3*, it is the exact opposite. This phenomena can be explained with the importance of aerodynamics. Explain the drag force

**A graph showing the number of countries/regions

AI-generated content may be incorrect.**

**Figure 1. Air Density at each track**

A graph of different types of gas

AI-generated content may be incorrect.

**Figure 2. Maximum Power results**

A graph of different types of gas

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**Figure 3. Top Speed results**

Discrepancies between real world and simulation data

**Next Steps**

Conducting a more comprehensive validation by obtaining entrance speed to straight, straight-line distance.

**Conclusion**

Initial model forecasts a consistent top‑speed uplift under 2026 regs. Full validation pending real data; however, insights will inform aerodynamic setup and MGU‑K calibration strategies.