**PhD Post in traffic flow modelling from fundamental diagrams to macroscopic fundamental diagrams**

**Supervisor:** Dr Sérgio Batista, Department of Civil and Environmental Engineering

**Background**

Congestion in metropolitan areas poses significant economic, environmental, and societal challenges. Traffic flow models offer a potential solution by helping to design strategies for mitigating these issues. These models often use fundamental diagrams to understand and manage congestion, illustrating the relationship between traffic flow, density, and speed on a road segment. While effective at capturing dynamics on specific road segments, fundamental diagrams fall short in modelling the complex, network-wide phenomena typical of urban areas. Aggregated traffic models based on the Macroscopic Fundamental Diagram offer a promising alternative, enabling low-cost, network-level traffic flow modelling. These models partition the urban network into interconnected regions where traffic is homogeneously distributed and regulated by the Macroscopic Fundamental Diagram, reflecting the relationship between average density and flow within each region. Traffic dynamics are then modelled as exchange flows between adjacent regions, enhancing the network-wide applicability of these models. However, understanding the consistency of aggregation across scales remains an open question.

**Project description**

This PhD project aims to advance traffic flow modelling by focusing on the development and refinement of fundamental diagrams and macroscopic fundamental diagrams. The research will explore advanced fitting techniques for fundamental diagrams and macroscopic fundamental diagrams, investigate the relationship between these diagrams at local and network levels, and examine the trade-offs in aggregating traffic variables for consistent scaling of the models. Through data-driven analysis and model validation, the project seeks to improve the accuracy and applicability of traffic models, ultimately contributing to better congestion management strategies in urban areas.

**Academic requirements and experience**

• A First Class Degree (or International equivalent), in civil engineering, applied mathematics, computer science, or closely-related disciplines.

• A master’s level degree qualification.

• Programming experience in Python and R.

• English language requirements (e.g., IELTS 6.5 overall, minimum 6.0 in all elements).

**How to apply**

Applicants wishing to be considered for this opportunity should send the following application documents to Dr Sérgio Batista (s.batista@imperial.ac.uk):

1. An up-to-date CV for the applicant including degree result and, if possible, class ranking.

2. A 1-2 page personal statement. The statement should discuss your motivation for pursuing a PhD degree and how it fits in with your desired progression or career aspirations.

3. English test results.

4. Contact details of two academic referees

Review of applications will begin immediately and continue until the position is filled. Application via the Imperial College Registry is not necessary at this stage.

**About the funding**

The studentship will provide funding for up to 3.5 years, including Home tuition fees (3 years) and a tax-free stipend at the standard UKRI London rate, £21,237 for the 2023/24 academic year, for 3.5 years. Full funding is available to Home students.

Other scholarships can be found on the university website: www.imperial.ac.uk/students/fees-and-funding/postgraduate-funding/scholarships/