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Aerodynamic Drag Between Two Cyclists: OverPressure Push and Effect of Wheel Rotation

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1 Abstract

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3 The aerodynamic drag force acting on a cyclist depends on several factors such as speed, wind magnitude,
4 wind angle, and drafting a second cyclist or group of cyclists. To expand knowledge in drag reduction
5 mechanisms associated with drafting conditions, the aerodynamic drag of two identical models of female
6 track cyclists was simulated in static and with simulated wheel rotations through a validated Computational
7 Fluid Dynamics (CFD) approach. Two sets of 11 simulations with and without wheel rotation at a wheel-
8 to-wheel distance between the two bikes ranging from 5 centimeters to 5 meters were carried out. Results
9 show that wheel rotation on an isolated cyclist model with his bike and equipment has a 3% larger drag
10 than the same model without wheel rotation. Furthermore, at the usual wheel-to-wheel distance of 0.15m,
11 two cyclists one behind the other show a 3.5% drag reduction for the leading cyclist and 35.2% drag
12 reduction for the trailing cyclist compared to an isolated one. The overall drag is higher with wheel rotation
13 than without it but the gain from OverPressure Push (OPP) and drafting stays similar. These results suggest
14 the implementation of wheel rotation and accurate 3D geometry in future CFD cycling models to make
15 them more realistic.

16 17 18 Keywords

19 Computational fluid dynamics
20 Wind tunnel
21 Aerodynamic drag
22 Track Cycling