

Rolling resistance of bicycle tires with ambient temperature in focus

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[Research](#) published in the *International Journal of Vehicle Systems*

Modelling and Testing has investigated how the rolling resistance of bicycle tires against the road surface are most affected by ambient temperature and the pressure to which the tires have been inflated. The findings could have implications for tire design and maintenance when considering the efficiency of e-bikes that have a motor to assist the cyclist's pedal power.

Malte Rothhämel of KTH Vehicle Dynamics at the Royal Institute of Technology in Stockholm, Sweden carried out controlled tests using a specially designed apparatus called a "one-degree-of-freedom, two-wheeled pendulum." This apparatus consisted of two bicycle wheels connected to a pipe with an attached eccentric weight (pendulum) and an additional centered weight to adjust the vertical load on the tires.

Rothhämel reports that as [ambient temperature](#) decreased, the rolling resistance coefficient increased. This was particularly noticeable above freezing point. It is essential that temperature dependency is taken into account when carrying out real-world testing, the work suggests.

He also found, as one might expect, that higher tire pressure resulted in lower resistance. Changes in vertical load had little effect on resistance, but needs to be taken into account when determining the friction coefficient. The width of the tires only had about a ten percent impact. Wider tires have slightly lower rolling resistance but this effect is more pronounced at higher tire pressure.

Air resistance and the incline and surface of the road also play a part, but generally, in urban cycling it is rolling resistance that plays the biggest part. That said, at higher speeds, [air resistance](#) also becomes a significant factor. Topology, traffic and wind also affect overall cycling efficiency.

Rolling resistance is an important factor in how much work a cyclist and their assistance motor if they are riding an e-bike needs to do on a

journey. Greater unwarranted resistance means the cyclist and the motor need to work harder, which means a greater drain on the battery. As [transport systems](#) begin to focus more on motor-assisted pedal power, there is a need to understand rolling resistance and efficiency to improve the journey and cut [energy costs](#) for e-bike riders.

More information: Malte Rothhämel, On rolling resistance of bicycle tyres with ambient temperature in focus, *International Journal of Vehicle Systems Modelling and Testing* (2023). [DOI: 10.1504/IJVSMT.2023.132317](#)

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