

Sustainable Intermodality and Railway Safety: The Lithium-Ion Battery Challenge

Reconciling the sustainable intermodality of transport systems with the growth of personal mobility vehicles (PMVs)—electric scooters, e-bikes, and unicycles—poses a challenge for railway operators in managing battery-related risks. Personal transport systems have assumed a prominent role in extending the rail journey, facilitating the “last mile.” However, battery failures (particularly lithium-ion batteries) are compelling railway authorities to analyse and regulate their use across different rail systems (metro, commuter rail, long-distance, and high-speed services).

As is well known, PMVs mainly use lithium-ion batteries, which offer high energy density and low weight—clear advantages. However, overheating or thermal runaway in these batteries presents a significant risk, particularly in enclosed, high-occupancy environments such as railway vehicles, stations, tunnels, and similar spaces.

Given the incidents associated with PMV use resulting from battery failures, many railway authorities have responded by regulating or restricting access to certain devices. In 2025, TfL (UK) banned the transport of non-folding electric bicycles and had previously prohibited electric scooters. Similarly, in 2023, Renfe (Spain) banned electric scooters from all its trains, citing public health and passenger safety criteria. These measures, which are being adopted worldwide, are not intended to discourage the use of Personal Mobility Vehicles, but rather to reduce the risks arising from defective batteries.

Current regulations seek to protect passengers; however, restrictions on transporting PMVs create a clear tension between safety and sustainability. The use of PMVs to facilitate last-mile transport—along with the inherent reduction in emissions and urban congestion—contrasts with the lack of harmonised standards regarding battery quality, certification, and source control, which complicates effective regulation.

Although railway authorities appear willing to seek solutions that promote sustainable intermodality, boosting the ‘last mile’, the technical and regulatory responses needed to effectively prevent, mitigate, and control overheating or thermal runaway in these batteries are still at an early stage.



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