



FIRE ENGINEERING

Capability Statement

FUTURE READY™

Electric Vehicles and Emerging Hazards

Growing concerns for climate change coupled with the drive to decrease urban pollution and decarbonise have led to an exponential growth in demand of the zero-emissions market for battery electric vehicles. This continuous shift to electric vehicles (EVs) is associated with new hazards, including fires involving lithium-ion batteries which release toxic and explosive gases that can be challenging to extinguish. These hazards are of particular concern in confined spaces and underground infrastructure, including enclosed car parks, transport interchanges and tunnels.



Core Competencies and Services

Services offered by the fire and life safety and tunnel ventilation teams within WSP Australia include:

- **Fire engineering assessments** and strategies
- **Analysis and modelling of fire, smoke, egress** using computational fluid dynamics (CFD) and pedestrian modelling tools
- **Fire risk analysis**
- **Building, fire and life safety codes** and specifications
- Fire and building authorities **permitting and compliance**
- Smoke and toxic gas **mechanical and natural ventilation design**
- **Structural fire modelling**, including analysis of concrete spalling
- **Fire detection**, alarms, and communication systems
- **Fire suppression** system design



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Project Spotlight

Zero Emissions Buses (Transport for New South Wales)

WSP produced a high-level strategic assessment of the fire and life safety risks of battery electric buses for input into the Zero Emission Buses business case. A series of fire risks were identified, and strategy and requirements were recommended including:

- Review local and international standards and legislation on EVs, manufacturing and infrastructure
- Review of vehicle battery fires and comparison of relative risk level between ICE vehicles and EVs
- Identification of fire risks of electric buses at charging facilities, depots, on open-air roads and in tunnels for passengers, other road users and surrounding communities
- Review impact of stabling arrangements, mass vehicle storage and depot layout on fire spread between buses and groups of buses
- Review of firefighting technologies for electric bus fires including fire hydrant systems, firefighting water supply, detection type options, alarm options and incident response

Electric Vehicle Fire Hazards in Tunnels (Transurban Queensland)

WSP provided guidance to Transurban on altered hazards relating to electric vehicle fires in the Clem7, Airport Link and Legacy Way tunnels. The scope of works included:

- Review of existing fire engineering reports to determine the difference between the vehicle fires used for the reports and fire sizes, growth rates, durations, temperatures associated with EVs
- Identification of options to manage EV fires and reduced the duration of asset unavailability extending to implications of fires on the fire suppression, smoke management and structures to determine if alternative fire safety measures were required
- Assessment on the management of pressurised flammable gases that may be emitted by lithium-ion batteries within a tunnel environment
- Management of contamination from firefighting water runoff to exposed surfaces and drainage systems
- Development of operational procedures to mitigate and to respond to EV fires
- Assessment of return to service timeline, cleaning processes for water, equipment contamination, vehicle removal from the incident location and post-incident management of incident vehicle

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Other Projects

Brisbane Metro Review – Independent review was conducted for underground infrastructure including charging stations for the Brisbane Metro

Toxic Gas and Egress Research – Engineering analysis was conducted using CFD, and available experimental data to simulate fire scenarios in a highway tunnel with occupants egressing. The CFD model accounted for the toxic gas species generated as a result of a vehicle fire (for both ICEV and EV) and their impact on nearby evacuating occupants. One of the goals of this study was to investigate whether electric vehicles can cause conditions in a tunnel fire to be more harmful.

Western Sydney Rapid Bus Depot and Layout – Development of an electric bus depot and vehicle layover sites, with fire engineering support for code-related and performance-based design elements. Site layouts and operations designed with support of first-principle fire engineering analysis. Hazards and opportunities review and detailed electric vehicle fire safety literature review provided to support and underpin fire safety design.

Brisbane Airport Domestic Terminal Carpark – A review of general hazards associated with electric vehicle charging and vehicle charging systems in the context of an existing, large, multi-storey, open-deck car park, and grouped vehicle charging bays. Review of potential impact of EV charging provisions upon the building's existing performance-based design elements. The review was used to contextualise a series of practical, management-in-use and fire strategy recommendations to manage residual risk associated with electric vehicle and charging provisions.

Recent Publications

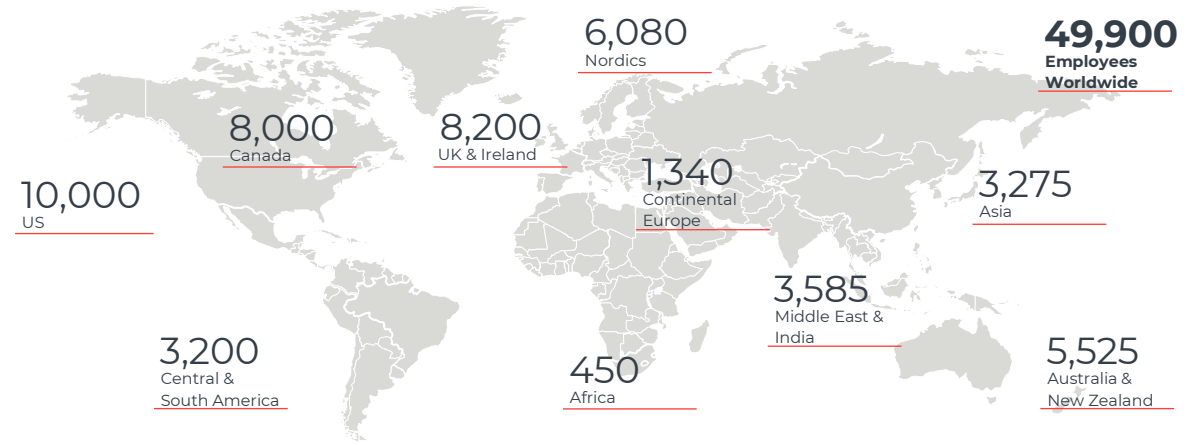
Bilson, Matthew (co-author) “Analysis of Fire-Life Safety with Battery Electric Vehicles in Highway Tunnels,” Nineteenth International Symposium on Aerodynamics, Ventilation and Fire in Tunnels. 2022

Bilson, Matthew (co-author). “Alternative Fuels and the Future of Road Tunnels and Road Tunnel Design,” Routes/Roads Issue Number 378. 2018



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We are locally dedicated with international scale



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