LOGISTICS UK

Euro 7 – emissions reduction technologies for on-road transport

Briefing note

The Euro emissions standard was introduced in 1992 (Euro 1) to reduce the pollutants emitted from vehicle exhausts. Since then, exhaust particulate matter (PM) has fallen substantially leaving the majority of road transport PM caused by non-exhaust emissions (NEE) from brakes, tyres and road surfaces. Additionally, electric vehicles (EV) may contribute proportionally more NEE due to their greater mass, unless mitigations are adopted.

This briefing summarises current and emerging technologies designed to reduce PM emissions from road transport, including brakes, tyres, on board capture systems, exhaust controls and roadside technologies. It also includes key cross cutting issues relating to EV battery weight, the limits this imposes on regenerative braking and the way in which Euro 7 standards will apply to EVs.

Particulate matter

PM is everything in the air that is not a gas, made up from a huge variety of chemical compounds and materials, some of which are toxic. When reporting UK emissions, PM is classified according to particle size:

- PM10 refers to particles smaller than 10 micrometres in diameter.
- PM2.5 refers to finer particles smaller than 2.5 micrometres.

The Euro 7 standard focuses on PM particles of 2.5 micrometres or less (PM2.5).

Euro 7

The Department for Transport (DfT) commissioned a *Horizon scanning report*[1] which confirms that while exhaust PM has declined sharply, non-exhaust emissions now represent the majority of PM2.5 and this trend will continue as EV uptake increases. The UK Government's current consultation on adopting the Euro 7 emissions standard recognises and confirms the policy direction set out in the *Horizon scanning report*[1]. In line with the evidence summarised in this briefing:

- Euro 7 proposes direct limits on brake particle emissions, applying equally to internal combustion engine (ICE) vehicles and EVs, reflecting the continued reliance of EVs on friction braking in certain operating conditions.
- Euro 7 will introduce standardised tyre abrasion measurement, using UNECE test methods referenced in the DfT report. While no explicit tyre PM limits are proposed at this stage, abrasion performance will become measurable and comparable across the market.
- The consultation reinforces that technology responses are expected to be incremental, with the greatest near term gains coming from improved materials (pads, discs, tyre compounds), system integration and operational controls rather than radical new technologies.

For electric vehicles in particular, the consultation aligns with the report's conclusion that higher vehicle mass increases baseline non exhaust emissions, meaning EVs may face a proportionally greater compliance challenge for brake and tyre PM under Euro 7 unless mitigations are adopted. Overall, the consultation confirms that the technologies and constraints described in this briefing remain the relevant and credible evidence base for understanding Euro 7's likely impact on vehicle design and fleet operations.

Detailed findings by technology group

Brakes (materials, design, regenerative braking)

Brake pad materials

New friction materials are being developed to reduce particulate emissions. Non asbestos organic (NAO) pads can reduce PM2.5 by 20–65%, but lower braking performance limits their suitability for UK/EU driving styles. Hybrid NAO/low metallic pads and pad formulations matched to low wear discs (eg Brembo's developments) aim to reduce PM while maintaining high braking

1 Review of PM2.5 reduction technologies for on road transport

capability and are expected to be widely available ahead of Euro 7 brake limits.

Brake disc technologies

Coated discs (notably tungsten carbide coatings applied via laser cladding) significantly reduce disc wear, delivering up to 80% PM2.5 reduction depending on the drive cycle. Their cost currently limits use to premium vehicles, but they are likely to become more common for heavier vehicles such as EVs which face tighter brake PM challenges under Euro 7 due to greater baseline emissions from higher vehicle weights.

Low wear cast iron discs paired with matched pads offer a lower cost retrofit option (eg Brembo 'Greenance'), already on the market.

Regenerative braking systems (RBS)

RBS is widely adopted in EVs, hybrids and fuel cell vehicles. It reduces reliance on friction brakes and can cut brake related PM2.5 by 50–80%.

However, the report identifies two important EV specific limitations:

- Battery capacity and state of charge limit how much regeneration can be used. For example, when the battery is full or at a low temperature the vehicle relies more on friction brakes, increasing PM.
- EV battery mass increases baseline brake wear. EVs typically weigh 190–430kg more (15–20%) than comparable ICE vehicles due to the battery. Higher inertia increases braking forces and therefore increases PM when friction brakes are used.

As a result, regenerative braking alone may not fully offset the non-exhaust PM impact of larger EV batteries, particularly on high braking or urban cycles unless combined with low emission pads/discs.

Assessment

Criterion	Assessment
PM2.5 mitigation	Pads: 20–65%; coated discs; up to 80%; RBS; 50–80% but constrained by EV battery state of charge (SOC) limits and EV mass.
Feasibility	High for pads/discs; coated discs particularly relevant for heavier EVs to meet Euro 7 brake limits.
Maintenance	Coated discs reduce replacement frequency; RBS may increase corrosion risk if friction brakes are infrequently used.

Tyre design and materials

Tyre abrasion is influenced strongly by vehicle mass, a key issue for EVs due to their heavier batteries. The report notes that EVs' 15–20% higher mass increases tyre shear force and temperature, raising tyre wear PM. Material improvements include:

- Silica and nanoclay fillers; 10–20% wear reduction.
- Butadiene rubber additives; improved abrasion resistance.
- ENSO (EV specific) tyres; >30% mass emission reduction and lower toxicity, with particular benefits for EV fleets.

The relationship between tyre abrasion and airborne PM remains uncertain. Reduced wear does not always directly equate to reduced PM2.5. EV torque characteristics also contribute to higher tyre wear unless mitigated.

Assessment

Criterion	Assessment
PM2.5 mitigation	Typically, 10–20%; ENSO demonstrates >30% mass reductions.
Feasibility	High drop-in replacements; EVs will be affected by forthcoming Euro 7 tyre abrasion limits.
Maintenance	Reduced wear may lower replacement frequency.

On board particle capture devices

Brake capture systems

- MANN+HUMMEL passive; 10–25% reduction.
- MANN+HUMMEL active; 60–80% reduction, small energy draw.
- Tallano TAMIC®; 83–85% PM10/PM2.5 reduction through vacuum assisted collection built into a grooved pad.

Given the greater brake PM challenge for heavier EVs, these systems could become more important for EV manufacturers to meet Euro 7 brake limits.

Tyre particle capture

- The Tyre Collective; 20–80% capture using electrostatic plates mounted behind wheels, currently trialling on light goods fleets.

Research indicates these devices may collect brake wear particles as well, which could support EV compliance in urban cycles.

Assessment

Criterion	Assessment
PM2.5 mitigation	Brake; up to 80–85%; Tyre: 20–80%.
Feasibility	Medium: retrofits feasible; original equipment manufacturer (OEM) integration likely for EVs facing Euro 7 limits.
Maintenance	Filter replacement every 1–24 months.

Exhaust emission controls (engine, fuels, after treatment)

ICE technologies

The report emphasises that exhaust related Euro 7 requirements for ICE vehicles will be met using existing mature after treatment systems. Diesel particulate filters (DPF) and gasoline particulate filters (GPF) remove >90% of particulate emissions. Selective catalytic reduction (SCR), lean nitrogen oxides trap (LNT) and ammonia slip catalyst (ASC) systems reduce nitrogen oxides (Nox) and ammonia slip, curbing secondary PM formation. Fuel quality (eg sulphur content, paraffinic fuels, biodiesel) significantly affects PM emissions.

Applicability to EVs

EVs produce no exhaust PM so Euro 7 tailpipe PM and particle number (PN) rules do not apply to them.

Assessment – Exhaust Controls

Criterion	Assessment
PM2.5 mitigation	Very high (>90%) for DPF/GPF; not applicable to EVs.
Feasibility	High–existing fitment.
Maintenance	Low.

Roadside technologies

Active systems such as Roadvent remove pollutants at source (up to around 91% NOx, with similar anticipated PM benefit) using suction slots embedded in drainage channels.

Standalone purifiers (eg WAYU) offer 19–25% PM2.5 removal. Vegetative barriers and porous asphalt can remove 20–80% and around 50% of particulate matter respectively. Costs and maintenance needs limit large scale rollout.

These solutions benefit areas with high public exposure (schools, hospitals, bus stops) but do not differentiate between vehicle type and so apply equally to EV dominant areas.

Assessment – Roadside Technologies

Criterion	Assessment
PM2.5 mitigation	20–80% (vegetation/biofilters); >90% for Roadvent.
Feasibility	Moderate–high; road resurfacing options have high cost and disruption.
Maintenance	Medium–high (filter replacements, vegetation care, cleaning).

Cross cutting – Euro 7 and implications for EVs

The report makes several specific points on how the Euro 7 rules will affect EVs.

EVs are fully subject to Euro 7 brake emission limits

Because EVs still rely on friction brakes in several scenarios (low speed, emergency stops, full battery), they must meet the same brake PM thresholds as ICE vehicles. Heavier EVs face a greater challenge, likely requiring:

- Coated discs on larger EVs.
- Low wear pads matched to disc materials.
- Potentially brake capture devices.

EVs will be affected by Euro 7 tyre abrasion standards

Although the standards are still emerging, the report states that Euro 7 is likely to "promote best available tyre technology" to control wear, which will directly affect EVs due to higher loads and torque.

Euro 7 tailpipe PM rules do not apply to EVs

Euro 7 exhaust limits concern particulate number >10 nm, NOx, and other tailpipe pollutants. These requirements do not apply to electric vehicles since they produce no tailpipe emissions.

Conclusion

- EVs reduce exhaust PM entirely but increase non-exhaust PM because of battery related mass.
- Euro 7 will apply equally to EVs for brake and tyre PM, likely accelerating uptake of coated discs, advanced pads and low abrasion tyres.
- Regenerative braking has strong PM benefits but is limited by battery SOC and cannot fully counteract the higher baseline wear caused by EV mass.
- On board and roadside technologies offer additional opportunities to mitigate PM2.5, particularly in high exposure locations or for heavy EV models.

Overall assessment

This section provides a consolidated overview of Technology Readiness Levels (TRLs) for the PM2.5 reduction technologies presented in this briefing note. TRLs indicate the maturity of each technology, ranging from:

- TRL 1-3; early-stage development.
- TRL 5–6; demonstrated in relevant environments, transition phase from laboratory to real world applications.
- TRL 7–8; demonstrated at operational scale, suitable for early deployment.
- TRL 9; fully commercialised solutions.

Brakes

Technology Type	TRL Range	Notes
Brake pad materials	TRL 5–9	Wide range reflects both established and emerging low wear compounds.
Coated discs (eg tungsten carbide)	TRL 7–8	Mature premium market technology; increasing relevance for heavier EVs.
Regenerative braking systems	TRL 8–9	Highly mature but limited by battery state of charge and temperature.

Tyres

Technology Type	TRL Range	Notes
Optimised compounds (silica, nanoclay, butadiene mixes)	TRL 6–9	Commercially available; improvements ongoing for EV torque loads.
ENSO low wear tyres	Medium–high TRL	Demonstrated >30% mass wear reduction; scaling underway.

On board capture

Technology Type	TRL Range	Notes
Brake particle capture systems	TRL 7–8	Retrofit and OEM integration options nearing market maturity.
Tyre particle capture systems	TRL 5–6	Early-stage but promising electrostatic collection technologies.

Roadside technologies

Technology Type	TRL Range	Notes
Vegetation, biofilters, porous asphalt	TRL 5–9	Highly variable maturity depending on the specific intervention.
Roadvent™ active roadside extraction	High TRL	Near-commercial system with around 91% pollutant extraction capability.

Exhaust controls

Technology Type	TRL Range	Notes
DPF/GPF, SCR, LNT, ASC	TRL 9	Fully mature technologies for internal combustion engines (not applicable to EVs).

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