



12 Pillars of Change

Defining the Road to Zero





Executive Summary

The transition to zero-emission road freight is not a technology problem. It is a coordination problem.

This report presents findings from 12 Pillars of Change: Defining the Road to Zero, a working session that brought together twelve sectors of the freight ecosystem to identify the barriers preventing operators from making the transition, and to establish where accountability sits for removing those barriers.

This is not a consultation. It is not a set of recommendations. It is a mapping exercise: what stands in the way, who currently owns it, and where the gaps in ownership exist. The conversation was structured around one principle: transport operators must be at the heart of any roadmap. They hold the operational data. They carry the commercial risk. They will live with the consequences of policy decisions made today. If the transition framework does not work for operators, it will not work at all.

The 12 Pillars



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What we found:

Time is the enemy. Operators face immediate decisions about technology with no certainty about which standards will prevail. They face a 2035 deadline for 26-ton rigid vehicles that almost nobody is discussing. They face a 2040 infrastructure requirement that is physically impossible to deliver if the industry waits until the last minute, which is exactly what truck operators do.

The most significant barriers are not financial. Planning permission rules, landlord restrictions, primary legislation timelines, and grid connection processes create friction that no amount of capital can overcome. Operators need acknowledgment of these barriers as much as they need them removed. Acknowledgment creates confidence. Confidence enables action.

Accountability is unclear or absent for critical coordination points. Who decides interim technology standards while the market matures? Who manages the competing energy demands on depot sites? Who ensures that DFT internal departments communicate with each other? Who coordinates the property sector, which owns the land but is not in the conversation?

The path to zero-emission freight will not be found by waiting for answers. It will be built by the industry itself, but only if the barriers are named, the accountability is assigned, and the coordination mechanisms are established.

This report does that work. It does not prescribe solutions. It maps the territory so that operators, government, infrastructure providers, and the wider ecosystem can navigate it together.

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Introduction:

The Coordination Challenge

Context

The path to zero-emission road freight has become politically and emotionally charged. Timelines, technologies, and fairness are debated before the conversation even starts. But there is no settled framework for trucks in the UK. There is still time to define something that actually works.

12 Pillars was designed as a line in the sand: a working session to bring the freight ecosystem together and define what a practical, grounded, and effective transition framework could look like for heavy-duty road transport.

This was not a panel. Not a showcase. It was a conversation, on the record, designed to move the industry forward.

Purpose of This Report

This report identifies the barriers preventing operators from transitioning to zero-emission vehicles and establishes where accountability sits for removing those barriers.

It does three things:

Maps the barrier landscape as operators experience it.

Not theoretical barriers, but the specific blockers that fleet operators, infrastructure providers, and adjacent sectors encounter in practice.

Identifies where accountability is unclear or absent.

Many barriers have no obvious owner. Some have multiple potential owners with no mechanism for coordination. Some are owned by parties not present in the conversation.

Creates a foundation for operators to build their own roadmap.

This report does not prescribe the roadmap. It provides the shared understanding of what needs deciding, by whom, and when, so that operators can lead the process.

What This Report Does Not Do

This report does not recommend specific technologies. It does not prescribe solutions. It does not create another consultation or dictate a playbook.

It acknowledges that the path to zero-emission freight will not look the same for every operator, and that multiple transition pathways exist depending on vehicle use case, operational profile, and infrastructure availability. The goal is not to settle the technology debate. It is to identify the barriers that prevent operators from engaging with it on their own terms.

Approach:

The roundtable discussion was divided into three sessions:

Session 1:

Current state -
where are we now?

Session 2:

End state - what
does 2040 look like?

Session 3:

Barriers and
roadmap - what
stands in the way?

This report focuses primarily on Session 3, with context from the other sessions where relevant. Throughout the discussion, one pattern emerged repeatedly: conversations about the ideal 2040 end state kept being pulled back to immediate problems and transition challenges. This tension between the end state and the path to get there is itself a barrier, and is addressed in Section 6 of this report.

Scope:

This report addresses barriers to zero-emission heavy-duty road freight in the UK, with particular focus on:

- Time pressures and decision-making windows
- Non-financial regulatory and legislative barriers
- Infrastructure coordination challenges
- Market standards and interoperability gaps
- Accountability and coordination mechanisms



The report is grounded in operator realities: what fleet operators, infrastructure providers, energy companies, vehicle manufacturers, and adjacent sectors are experiencing on the ground, not what policy documents suggest they should be experiencing.

This report focuses on coordination barriers rather than financial barriers. While capital costs, total cost of ownership, and financing mechanisms are critical to transition success, they are not the primary focus here. The roundtable was planned to include finance sector representation but this was not possible on the day.

More importantly, this report does not address the structure of incentives, a significant gap identified by industry feedback. To date, policy has often relied on punitive incentives (fines, clean air zones, compliance mandates) to drive behaviour change. For a low-margin industry like freight, where operators work on tight cash flows and thin profit margins, fine-based incentives may accelerate business failure rather than transition. The question of what alternative incentive structures might be more appropriate for the freight sector - and who should design them - remains unresolved and sits outside the scope of this coordination-focused analysis.





2. Time - The Cascading Pressure Points

Time is the single most critical barrier in the transition to zero-emission freight. Not because the deadlines are unrealistic, but because multiple time pressures are colliding, each requiring different decisions from different actors at different points, with no coordinated timeline.

Operators are being asked to make irreversible capital investments now, into technologies that may not be the winning standard, to meet deadlines that are staggered across different vehicle categories, while the infrastructure required to support those investments will not exist unless multiple parties coordinate delivery at scale.

The problem is not that operators do not understand urgency. The problem is that the system is not designed for the way operators actually make decisions.

Immediate Decisions (Now to 2025)

The Barrier: Operators need to make decisions now about technology and infrastructure, but do not know which standards will prevail.

Technology uncertainty includes:

- Battery chemistry (solid state vs current lithium-ion)
- Charging standards (MCS vs CCS vs proprietary systems)
- Vehicle-infrastructure communication protocols
- Grid connection requirements and costs

Each of these has implications for depot infrastructure. Installing charging equipment today that becomes obsolete in three years is not a recoverable investment for most operators.

Accountability: The market will eventually standardise, but "eventually" does not help operators who need to place orders in 2025. Industry groups are working on standards development, but these processes move slower than procurement cycles.

Current owner: Fragmented across OEMs, charge point manufacturers, industry bodies, and EU regulatory alignment.

Accountability gap: No single body is responsible for communicating interim guidance to operators about which technologies are safe bets versus which remain speculative. Operators are left to interpret signals from multiple sources, each with commercial interests.

Impact: Paralysis. Operators with capital available to invest are not deploying it because the risk is too high. This delays the transition, not because of lack of funding, but because of lack of certainty.



From the roundtable:



Solid state batteries? MCS charging? We can't afford to back the wrong technology. It's our entire family life on the line.

This is not hyperbole. For small and medium-sized operators, a single vehicle purchase represents a multi-year capital commitment. Getting it wrong means operational failure, not just inefficiency.

Near-Term Scaling (to 2030)

The Barrier: The transition needs to shift from tens of vehicles to thousands, but the infrastructure and supply chains are not in place to support that scale.

The ZEHID (Zero Emission Heavy Duty Infrastructure Demonstrator) programme is beginning its demonstrator phase. This means the industry is moving from proving concepts work to deploying them at scale. The gap between these two phases is significant.

Infrastructure requirements:

- The EU needs 500 public chargers per month to reach 35,000 by 2030.
- MCS (Megawatt Charging System) is still mostly on a trial basis.
- Grid reinforcement timelines measured in years, not months.

Vehicle availability:

- OEM production levels are still low.
- Lead times can be long.
- Not all use cases have suitable vehicles available yet.

Accountability:

Current owners:

- Government: ZEHID programme, infrastructure targets
- OEMs: Vehicle production ramp-up
- Charge point operators: Public infrastructure deployment
- DNOs: Grid reinforcement

Accountability gap: No coordination mechanism between these actors. Each is working to their own timeline. An operator might secure a vehicle only to find grid capacity unavailable. Or they might get grid approval only to find no suitable vehicle in production. The interdependencies are not being managed at system level.

Impact: The 2030 checkpoint is not being treated as a checkpoint by most parties. It is being treated as distant enough to defer action, which guarantees that 2030 will arrive with inadequate infrastructure in place.

From the roundtable:



We're meant to be scaling up, but where are the vehicles? Where are the chargers? Who's building the grid capacity?



The Forgotten Deadline (2035)

The Barrier: 7.5 - 26-ton rigid vehicles face a 2035 deadline that is barely being discussed.

Why this matters:

- Significant portion of the UK fleet
- Often used for specialist applications (refuse collection, concrete mixers, tippers, specialist construction equipment)
- May require bespoke solutions due to ancillary equipment power demands
- Less attention from OEMs compared to high-volume categories

Accountability:

Current owner: No one. Government policy sets the deadline. OEMs will eventually produce vehicles. But there is no active work programme addressing the specific challenges of this category.



Accountability gap: Complete. This deadline exists in legislation but not in anyone's delivery plan.

Impact: Operators in this category have seven years to transition but no clarity on what they are transitioning to. By the time this becomes urgent (likely around 2032-2033, following typical operator behaviour), it will be too late to develop and deploy suitable solutions at scale.



From the roundtable:



***My specialist kit is all in this bracket. 26-ton rigid.
And nobody is talking about it.***

The focus of most transition planning is on articulated lorries and lighter commercial vehicles. The < 26-ton rigid category sits in between and is being overlooked.

Infrastructure Delivery Reality (to 2040)

The Barrier: The 2040 end state requires approximately 10,000 sites to be grid-connected and equipped with charging infrastructure. If the industry waits until it becomes urgent, it will be physically impossible to deliver.

Operator behaviour:

"That's what truck operators do. We wait until the very last minute. We have to. Cash flow doesn't allow early investment in depreciating assets."

This is rational economic behaviour. But it creates a collective action problem. If all operators wait, the system becomes overwhelmed.

The delivery bottleneck includes:

- DNO grid reinforcement capacity (engineers, materials, consents)
- Construction sector capacity (electrical contractors, equipment installation)
- Manufacturing lead times (transformers, switchgear, charging units)
- Planning permission processes (local authority capacity)

Accountability:

Current owner: Theoretically distributed across all operators, infrastructure providers, and local authorities. In practice, no one owns the sequencing and pipeline management.

Accountability gap: No mechanism exists to manage demand signals, coordinate delivery pipelines, or prevent the system from becoming overwhelmed by last-minute demand.

Impact: The window for orderly transition is narrowing. Every year that passes without coordination is a year lost from the delivery timeline. By 2035, the rush begins. By 2038, it may already be too late to deliver infrastructure at the required pace.



From the roundtable:



We're only 2-3 asset lifecycles away from 2040. That's not very long. And we need 10,000-plus sites connected. If everyone waits and hits the brick wall together, the DNOs and contractors physically cannot deliver that volume.

This decade, we came in one way, we're going out completely different. None of us have a roadmap yet. But recognising the problem is halfway to solving it.

The Core Time Problem

The time barrier is not fundamentally about deadlines being too aggressive. It is about mismatched timelines and uncoordinated decision-making.

Operators need certainty in 2025 about technology standards that will not be fully settled until 2027-2028.

Grid infrastructure needs to be planned and consented in 2025-2026 for delivery in 2028-2030.

Vehicle orders need to be placed 12-18 months before delivery, but operators cannot order without knowing infrastructure will be ready.

Legislation operates on election cycles and parliamentary timetables that do not align with asset replacement cycles or technology development timelines.

These timelines are not synced. No one is responsible for syncing them. And the longer this continues, the narrower the delivery window becomes.

What is needed:

Not a single master timeline (which would be inflexible and unrealistic), but a mechanism for making the interdependencies visible and for managing the critical path. Operators can manage risk. They cannot manage invisibility.





3. Non-Financial Barriers

The conversation about zero-emission freight transition is dominated by discussions of capital cost, total cost of ownership, and funding mechanisms. These are real barriers. But they are not the only barriers, and in many cases they are not the most significant ones.

From the roundtable:



***Sometimes it's not about fiscal incentives.
It's about removing barriers instead***

This section addresses the barriers that no amount of capital can overcome: regulatory processes, legislative timelines, property rights, and administrative friction. These barriers are often invisible to policymakers because they sit in the gap between policy intent and operational reality.

Planning Permission

The Barrier: Installing charging infrastructure at depot sites requires planning permission. The processes are inconsistent across local authorities, timelines are unpredictable, and outcomes are uncertain.

For operators, this creates a sequential dependency: secure the vehicle order, then apply for planning permission, then wait, then (if approved) procure and install equipment. Any delay in the planning stage cascades through the entire project timeline.

Accountability:

Current owner: Local planning authorities, operating under national planning policy framework.

Accountability gap: No standardised approach to EV charging infrastructure applications. Each authority interprets policy differently. No fast-track process exists for infrastructure that supports national policy objectives.

Impact: Adds months to project timelines. Creates uncertainty that prevents operators from committing capital. In some cases, results in outright refusal for reasons that may be legitimate locally but undermine national transition goals.

Landlord Restrictions and the Right to Plug:

The Barrier: Many operators lease their depot facilities. Landlords can refuse permission to install charging infrastructure, even when the operator is willing to bear the full cost.

Accountability:

Current owner: Contract law and property rights. Landlords have no obligation to facilitate charging infrastructure.

Accountability gap: No "right to plug" equivalent to the "right to charge" that exists for residential EV charging in some contexts. No policy mechanism to balance property rights against transition requirements.

What operators need: Not necessarily a legal right to override landlords, but a framework that makes cooperation the path of least resistance. This could include model lease clauses, landlord incentives, or dispute resolution mechanisms.

Impact: Locks a portion of the fleet out of depot charging entirely, or forces operators to relocate at significant cost, which may not be economically viable for smaller businesses.

From the roundtable:



If you're renting your premises, you can't install a charger without landlord permission. And landlords can just say no.

This is not a theoretical problem. It affects a significant portion of the operator base, particularly smaller operators who are more likely to lease rather than own facilities.

Axle Weights and the Power of Acknowledgment

The Barrier: Zero-emission vehicles are heavier than diesel equivalents due to battery weight. This reduces payload capacity unless axle weight limits are increased.

Why this matters: Operators make decisions based on expected direction of travel, not just current rules. If government acknowledges that weight limits are a known issue and signals intent to address it (even if the timeline is uncertain), operators can factor that into their planning. Without acknowledgment, operators must assume the current rules are permanent.

Accountability:

Current owner: DfT for policy position, Parliament for legislation.

Accountability gap: No formal mechanism for government to signal "we recognise this issue and intend to address it, timeline TBC" without creating a legislative commitment. Informal signals are not sufficient for operators making capital decisions.

Impact: The absence of acknowledgment is itself a barrier, regardless of whether the underlying policy can be changed quickly. This is a low-cost, high-impact intervention that is not happening.



From the roundtable:



Weights are the single biggest thing to level the playing field.

Not necessarily a legislation change, but acknowledgment. A view that we're all moving in the right direction. Confidence from acknowledgment alone.

MOT Testing Requirements

The Barrier: MOT testing regimes are designed for diesel vehicles. Zero-emission vehicles have different maintenance requirements and failure modes. The testing regime has not yet adapted.

This creates uncertainty about compliance and maintenance obligations, which affects whole-life cost calculations and operational planning.

Accountability:

Current owner: Driver and Vehicle Standards Agency (DVSA).

Accountability gap: No published roadmap for adapting MOT requirements to zero-emission vehicles. No formal consultation with operators about what testing regime would be appropriate.

Impact: Minor in the short term (few zero-emission HGVs on the road yet), but will become significant as fleet scales up. Addressing it now, while numbers are low, is easier than retrofitting a testing regime to thousands of vehicles.



Charge Point Operator (CPO) Regulations

The Barrier: If operators share charging infrastructure with other fleets, they risk being classified as a CPO, which brings significant regulatory obligations.

This discouraged infrastructure sharing and prevented efficient use of capital.

Status: This barrier has been partially addressed. Legislation was changed to exempt behind-the-gate workplace charging from CPO regulations.

Accountability:

Current owner: DfT (policy), Ofgem (regulatory framework).



Resolution: Achieved through pre-emptive policy work. This is an example of barrier removal working as it should.

Remaining gap: May need further refinement as business models evolve and infrastructure sharing becomes more sophisticated. The line between workplace charging and public charging may blur.



From the roundtable:



People have said, if I open up my charging infrastructure too much, I'm going to be regulated as a CPO. I don't know if there's something there where you can actually nudge those depots to share.

They changed the legislation. So if it is behind the gate, then you're not a CPO. You can, as workplace charging, get around that legislation.

The Missing 13th Pillar

- Property

The Barrier: The property sector owns the land where depots sit, but property owners and estate managers were not represented in the 12 Pillars discussion.

The East Midlands Gateway example was cited: a logistics park where landlords and estate owners are critical coordination points for infrastructure deployment, but they are not part of the freight decarbonisation conversation.

Why this matters:

- Landlords control access to buildings and land
- Estate-wide infrastructure coordination requires landlord participation
- Solar deployment on warehouse roofs requires landlord investment or consent
- Grid connections often need to be negotiated at estate level, not individual tenant level

Accountability:

Current owner: No one. Property sector is not seeing this as their problem. Freight sector cannot solve it without property sector participation.

Accountability gap: Complete. The property sector is not at the table, and there is no mechanism to bring them into the conversation in a structured way.

Impact: Missed opportunities for coordinated infrastructure deployment. Individual operators negotiate with landlords in isolation, resulting in suboptimal outcomes. Estate-wide solutions (shared grid connections, coordinated charging infrastructure) are not being explored.



From the roundtable:



If there was a 13th pillar, you might have property people. It's nonsense that there's hardly any solar on warehouse roofs.

The Pattern: Administrative Friction

The common thread across all non-financial barriers is administrative friction. These are not problems that require new technology or significant capital. They are problems of process, coordination, and clarity.

From the roundtable, DfT:



The door is open for grown-up conversations. Help you work through the legislation in place. Start to communicate internally.

(DfT is not one organisation).

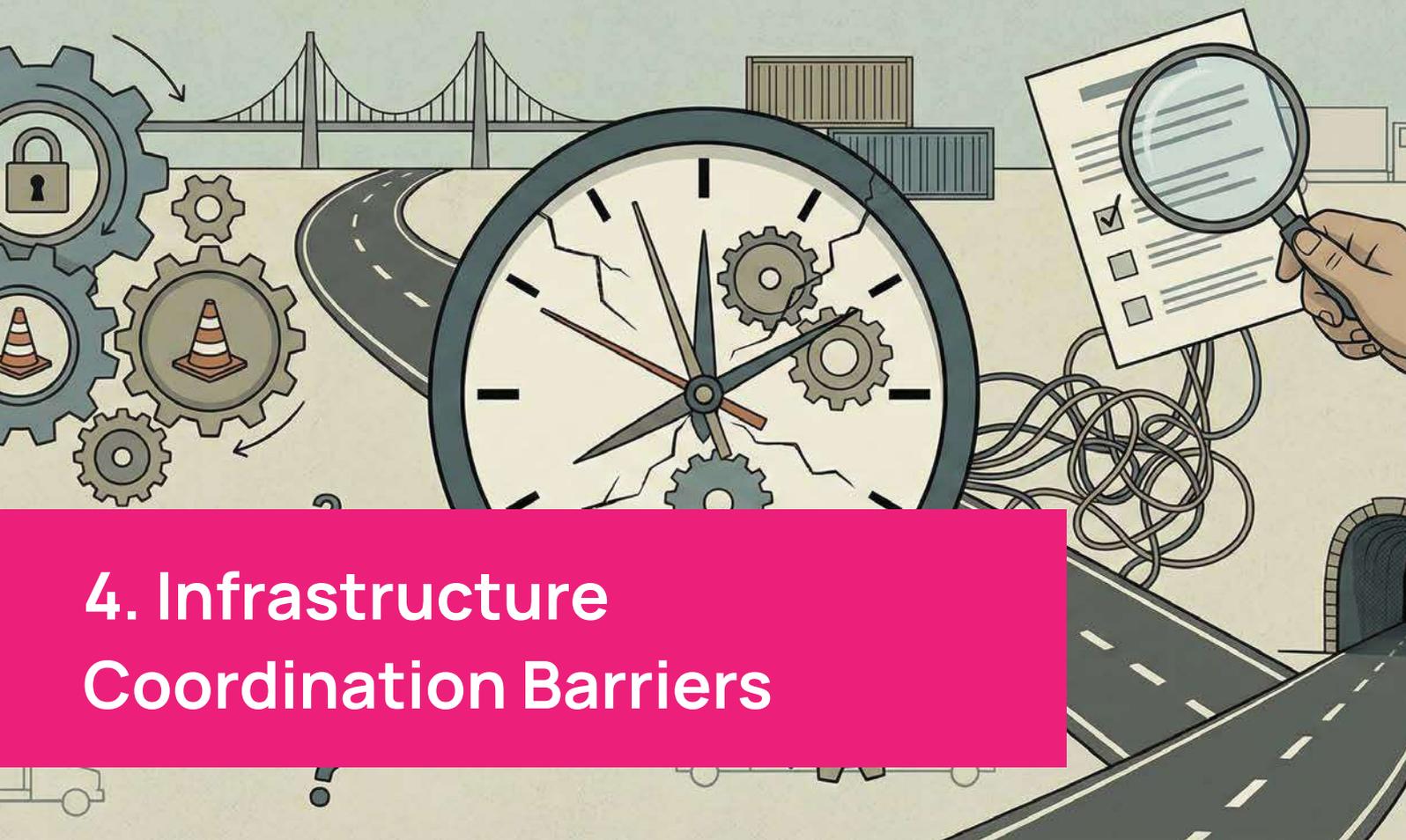
This willingness is valuable. But it places the burden on individual operators to navigate complexity, identify which barriers can be removed, and make the case for change.

What is missing:

A proactive mapping of non-financial barriers, assessment of which can be addressed through secondary legislation or administrative change, and publication of a timeline for addressing them.

Operators can work with uncertainty if they know what the uncertainty is. They cannot work with invisible barriers that only become apparent when they attempt to act.





4. Infrastructure Coordination Barriers

The time barrier is not fundamentally about deadlines being too aggressive. It is about mismatched timelines and uncoordinated decision-making.

Operators need certainty in 2025 about technology standards that will not be fully settled until 2027-2028.

Grid infrastructure needs to be planned and consented in 2025-2026 for delivery in 2028-2030.

Vehicle orders need to be placed months before delivery, but operators cannot order without knowing infrastructure will be ready.

Legislation operates on election cycles and parliamentary timetables that do not align with asset replacement cycles or technology development timelines.

These timelines are not synced. No one is responsible for syncing them. And the longer this continues, the narrower the delivery window becomes.

What is needed:

Not a single master timeline (which would be inflexible and unrealistic), but a mechanism for making the interdependencies visible and for managing the critical path. Operators can manage risk. They cannot manage invisibility.

Lack of Transparency on Available Grid Capacity

The Barrier: Operators cannot easily determine whether grid capacity is available at their site until they formally apply for a connection. This creates a sequential risk: commit to vehicles, apply for grid connection, discover inadequate capacity, face years-long wait for reinforcement.

Grid capacity data exists. DNOs hold it. But it is not published in a format that allows operators to conduct early-stage feasibility assessments.

Accountability:

Current owner: Distribution Network Operators (DNOs), six regional monopolies covering Great Britain.

Accountability gap: No requirement for DNOs to publish capacity availability in a standardised, accessible format. Each DNO has different systems and processes. Operators must navigate six different approaches depending on where their depot sits.

Impact: Operators cannot plan effectively. Site selection decisions are made without knowing whether the site can support the required electrical load. By the time this becomes apparent, the operator has already committed capital to property, creating a sunk cost that prevents relocation.



Inconsistent Processes Across DNOs

The Barrier: Each DNO has its own application process, timeline, costing methodology, and technical requirements. What works in one region may not work in another.

For operators with multi-site fleets (which is most large operators), this means navigating six different bureaucracies simultaneously, with no common standards or service agreements.

Accountability:

Current owner: Individual DNOs, operating within regulatory framework set by Ofgem.

Accountability gap: No common service agreement across DNOs. No standardised timeline commitments. No transparency on how connection costs are calculated or what factors drive them.



What is needed: A national service agreement that sets minimum standards for application processing, timeline commitments, cost transparency, and technical requirements. Not standardisation of the networks themselves (which have legitimate regional differences), but standardisation of the interface between operators and DNOs.

Impact: Administrative burden on operators. Unpredictable timelines. Difficulty in planning multi-site deployments. Lack of comparability between regions, which affects site location decisions.



"Measure Twice, Cut Once"

The Barrier: Operators need to install charging infrastructure now, but will need to upgrade capacity later as fleet electrifies further. The temptation is to ask DNOs for ultimate 2040 capacity upfront. But this triggers larger grid reinforcement requirements, longer timelines, and higher costs than may be necessary in the near term.

The coordination problem: Operators need to communicate long-term requirements without triggering immediate delivery of full capacity. DNOs need to plan reinforcement based on aggregated demand signals, not individual site requirements. But there is no mechanism for having this conversation.

Accountability:

Current owner: No one. Operators are responsible for their own sites. DNOs are responsible for the network. But the strategic conversation about phased delivery aligned to transition timelines is not happening.

Accountability gap: No structured process for operators to signal long-term requirements, for DNOs to aggregate those signals, and for both parties to agree a phased delivery plan that minimises cost and disruption while maintaining flexibility.

Impact: Operators either over-specify and pay for capacity they do not need yet, or under-specify and face costly retrofits later. DNOs cannot plan network reinforcement effectively because they do not have good forward visibility of demand.

What this requires: A planning process that sits between high-level national forecasts and individual connection applications. Operators need to be able to say "here is where we are going, here is the timeline, here is what we need when" in a format that DNOs can use for planning without it becoming a binding commitment.

From the roundtable:



Don't go to the DNO asking for your ultimate 2040 capacity upfront. But understand what you ultimately need. Cut through your damn reinforced concrete once. Put the conduits in even if not the cables yet.

Competing Energy Demands on Depot Sites

The Barrier: Depot sites are facing three simultaneous energy transition demands:

- 1. Transport electrification**
(vehicle charging)
- 2. Heating decarbonisation**
(heat pumps, electric heating)
- 3. AI and digital infrastructure**

Why this matters: A depot operator applying for grid capacity to install vehicle charging may find that the building's other energy requirements have already consumed available capacity. Or that the cost of reinforcement is driven by peak demand from multiple uses, not just vehicle charging.

Accountability:

Current owner: Building owners and operators, trying to balance multiple demands with limited capital and grid capacity.

Accountability gap: These competing demands are being addressed through separate policy frameworks (transport decarbonisation, heat and buildings strategy, digital infrastructure) with no mechanism for coordinating at the point of delivery (the actual building). The transition is being framed as a fleet operator problem, but the fleet operator may only control one of three demands on the site's energy system.

Impact: Suboptimal solutions. Potential underinvestment in one area to accommodate another. Missed opportunities for integrated energy management (solar, battery storage, demand-side response) that could address multiple needs simultaneously.

What is needed: Recognition that depot electrification is part of a broader building energy transition, and that policy and funding mechanisms need to reflect this. An operator installing vehicle charging should be able to consider heat pumps, solar, and battery storage as part of the same project, accessing the same funding and technical support.

From the roundtable:



Not just fleet operator responsibility, despite how it's framed.

Corporate buildings with fleet operations are being asked to decarbonise transport, decarbonise heating, and support increasing digital infrastructure requirements, all within the same electrical capacity envelope.

Long-Haul Charging Requirements

The Barrier: Long-haul operations cannot rely solely on depot charging. They require public charging infrastructure along strategic routes. But public infrastructure deployment is lagging.

The EU requires 500 public chargers per month to reach 35,000 by 2030. Current deployment rates are not meeting this trajectory. MCS (Megawatt Charging System) is still mostly on a trial basis.

Accountability:

Current owner: Theoretically, government (for targets and policy), Charge Point Operators (for delivery), and National Highways (for strategic road network).

Accountability gap: Government has set targets but not delivery mechanisms. CPOs will deploy where business case exists, but long-haul charging may not be commercially viable without anchor tenants or subsidies. National Highways has limited direct role in charging infrastructure provision.

No one owns the coordination between these parties or the delivery of a coherent network.

Impact: Long-haul operators cannot transition because the infrastructure to support their operations does not exist. This affects a significant portion of the freight sector: logistics operations, long-distance haulage, international freight.



Infrastructure as Opportunity for Broader Improvements

The Barrier: Charging infrastructure requires facilities (security, lighting, weather protection). These facilities could also address other industry needs, particularly driver welfare and the driver shortage.

Why this matters: The UK freight sector has a significant driver shortage. Working conditions, particularly facilities at depots and service areas, are a contributing factor. Women are particularly underrepresented in the sector, partly due to inadequate facilities.

Building charging hubs creates an opportunity to address these issues simultaneously. But this requires coordination between transport decarbonisation policy and driver welfare policy.

Accountability:

Current owner: No one is joining these dots at policy level.

Accountability gap: Charging infrastructure funding and planning processes do not consider driver welfare as an objective. Driver welfare initiatives do not coordinate with infrastructure deployment.

Impact: Missed opportunity. Infrastructure is being built that could improve driver welfare and recruitment but does not, because the two conversations are happening separately.

What is needed: Charging hub design standards that include driver facilities as a default requirement, not an optional add-on. Funding mechanisms that support the full facility, not just the electrical infrastructure. Recognition that addressing driver shortage and decarbonising transport are not separate problems.



From the roundtable:



There's a lack of drivers, especially women. Charging hubs need facilities anyway - cameras for security. Build showers, kit drying, safe environments. Kill two birds. Create the future environment you would like drivers to be in.

The Invisible End State

There was strong consensus in the roundtable about what the end state should look like:

- No queuing at charging points (like petrol stations)
- No thinking about fuelling - it just happens
- Automated payment, seamless integration
- Vehicles always plugged in somewhere (depot, destination, en route)
- Consistent OEM designs (port locations)
- No booking needed (enough infrastructure that any parking space has charging available)

The problem: This end state requires massive infrastructure deployment, but also requires market coordination and standardisation that is not happening. The path from today's friction-filled reality to the seamless future is not being actively managed.

Accountability:

Current owner: No one. The end state is a shared vision, but no party is responsible for ensuring the system evolves towards it.

Accountability gap: The path from current state to end state involves decisions about interoperability, payment systems, network design, and coordination between multiple commercial parties. These decisions are being made piecemeal, if at all.

Impact: Risk of suboptimal lock-in. Standards and systems being built now may not support the seamless end state. By the time this becomes apparent, significant capital will be sunk into infrastructure that works, but not well.



The Core Infrastructure Problem

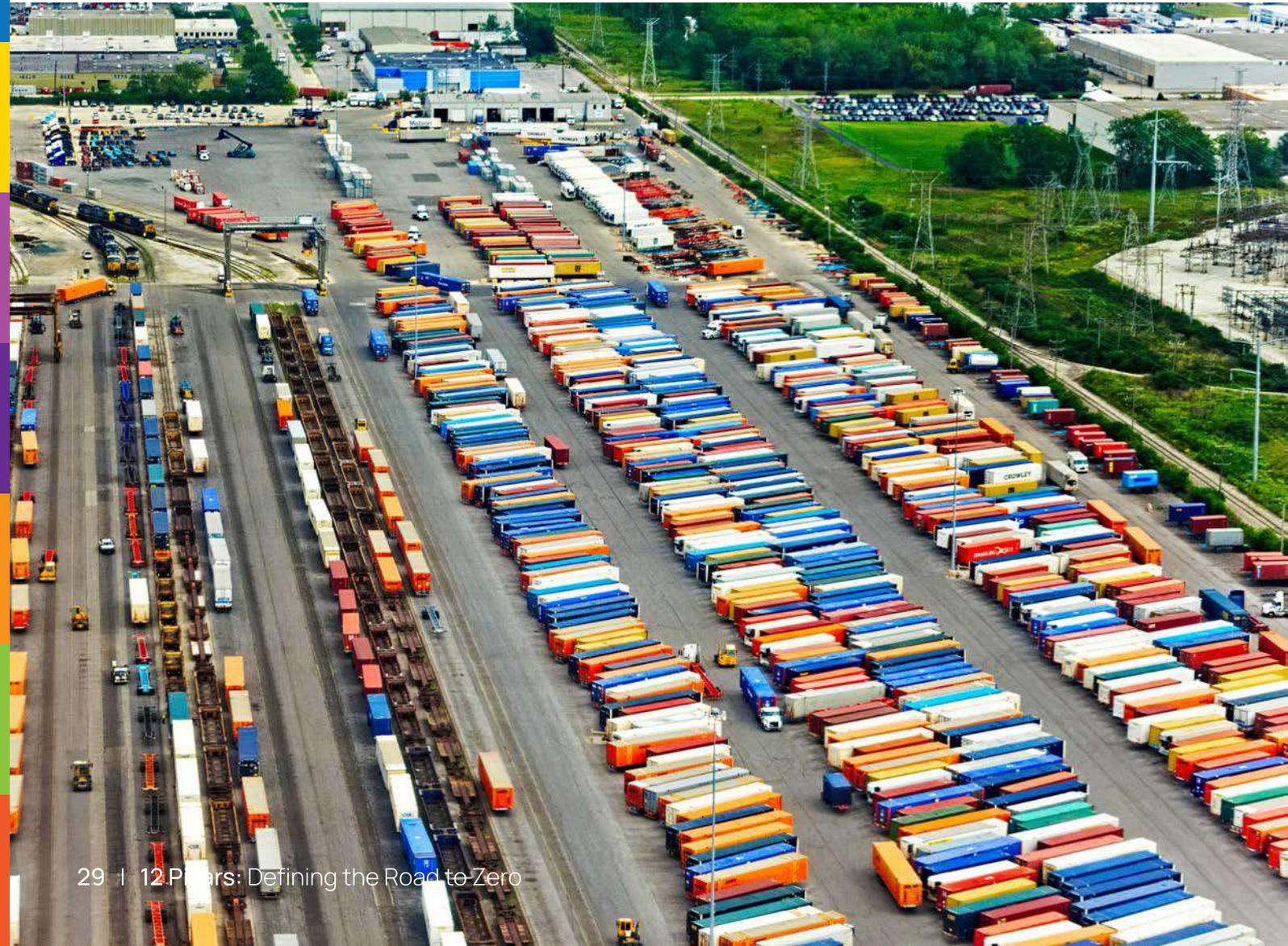
Infrastructure coordination is not about building things. It is about making sure the right things get built in the right places at the right times, in a way that works together.

This requires:

- Visibility of what others are planning
- Mechanisms for coordinating timing and location
- Shared standards and interoperability
- Strategic planning that bridges the gap between national targets and site-level delivery

None of these exist in a structured form. Each operator, DNO, CPO, and local authority is making decisions with limited visibility of what adjacent parties are doing.

The result is predictable: suboptimal outcomes, duplicated effort, missed opportunities, and infrastructure that does not quite work together even though each individual piece is functioning.





5. Market Standards and Interoperability

Markets eventually standardise. Competing technologies consolidate. Interoperability emerges as a commercial necessity. This is well understood.

The problem is the interim period. The years between now and eventual market standardisation are the years when operators must make capital commitments. The friction created during this period is not theoretical. It has real operational and financial consequences.

This section addresses the barriers created by the absence of standards, the lack of mechanisms to manage interim friction, and the gap between where the market is heading and what operators need today.

The Standardisation Gap

The Barrier: Different charging systems use different protocols for vehicle-infrastructure communication. Some use MAC addresses, some use registration plate identification, some use proprietary systems.

Why this matters:

- Payment systems need to identify vehicles
- Access control needs to verify authorisation
- Energy management systems need to communicate with vehicles
- Billing systems need to allocate costs correctly

If these systems are not interoperable, operators face administrative burden and operational complexity. For small operators, this complexity may be a barrier to adoption entirely.

Accountability:

Current owner: OEMs, charging infrastructure providers, and payment system providers, each making independent decisions.

Accountability gap: No mechanism for coordinating standards development at the speed required by operators making near-term decisions. Industry bodies exist, but they operate on longer timelines than procurement cycles.

Impact: Operators building charging infrastructure today do not know whether the systems they install will work with vehicles they procure in three years. Suppliers are not coordinating on interoperability because there is no requirement or expectation that they do so.



From the roundtable:



I think there's a standard of using MAC addresses on vehicles rather than having registration plate identification or whatever that might be.

This sounds technical, but it has practical implications. An operator with a mixed fleet might need different payment systems, different access credentials, and different back-office integrations depending on which vehicles they are charging where.

OEM Consistency

The Barrier: Different vehicle manufacturers place charging ports in different locations, use different connector types (within the standards), and have different requirements for charging infrastructure.

This creates depot design challenges. A depot designed for one OEM's vehicles may not work optimally for another's.

Accountability:

Current owner: OEMs, operating independently.

Accountability gap: In the long term, market pressure will drive standardisation. Fleet operators will demand consistency, and OEMs will respond. But this takes years. Operators making decisions now face uncertainty.

Impact: Depot infrastructure must be designed with flexibility to accommodate different vehicle configurations, which adds cost and complexity. For mixed fleets (which are common), this is a significant operational challenge.



The Fragmented Payment Landscape

The Barrier: Different charging networks use different payment systems. Operators need multiple accounts, multiple apps, multiple payment methods.

Why this matters: For long-haul operations in particular, drivers need to charge at multiple locations along a route. If each location requires a different payment method or pre-registration, this adds operational burden and increases likelihood of delays.

Accountability:

Current owner: Individual charge point operators, each operating their own payment systems.

Accountability gap: No requirement for interoperability. No standardised roaming agreements. No coordinated approach to simplifying the user experience.

Market forces should eventually drive consolidation and interoperability, but the interim period imposes costs on operators that could be avoided with coordination.

Impact: Administrative burden on operators. Driver training requirements. Increased risk of vehicles being unable to charge due to payment system issues. For smaller operators, the complexity of managing multiple payment accounts may be a barrier to long-haul adoption.



From the roundtable discussion on the end state:



Automated payment. Always plugged in somewhere. Seamless.

The gap between this vision and current reality is significant. Today, payment systems are fragmented. Roaming agreements between networks are incomplete. Some networks require pre-registration. Others accept ad-hoc payment but at premium rates.

Operators Hold the Critical Data

The Barrier: Policymakers need operational data to make informed decisions, but the data sits with operators, and there is no mechanism for aggregating and sharing it in a way that protects commercial sensitivity while informing policy.

What data operators hold:

- Actual vehicle utilisation patterns (duty cycles, daily mileage, charging windows)
- Real-world energy consumption and efficiency
- Operational constraints (turnaround times, loading/unloading durations)
- Infrastructure performance (charging speeds, reliability, costs)
- Total cost of ownership in real operational conditions

This data is commercially sensitive. Individual operators cannot share it without losing competitive advantage. But in aggregate, it would enable better policy decisions, more accurate forecasting, and more targeted support mechanisms.

Accountability:

Current owner: Individual operators, holding data they cannot easily share.

Accountability gap: No trusted intermediary or mechanism for aggregating operational data in a way that protects commercial interests while informing policy. Government relies on modelling and assumptions rather than real operational data.

Impact: Policy decisions made with incomplete information. Support mechanisms designed around theoretical use cases rather than actual operational patterns. Risk of "wrong legislation and wrong policy" being adopted because the right data never reached the right people.

What This Requires: Not a mandated reporting obligation (which would be burdensome and potentially counterproductive), but a trusted data-sharing mechanism that allows operators to contribute anonymised operational data to inform policy without exposing commercial positions.

This could be structured through industry bodies, academic institutions, or a purpose-built data trust. The key is building confidence that data will be used appropriately and will not disadvantage contributing operators.

From the roundtable discussion:



How do we ensure that when they're trying to make decisions about policy and legislation, the people with the data are sat here in this room. We all know that industry makes better, more astute business decisions than government.

We've got to make sure that data gets into the hands of the right people before the wrong legislation and the wrong policy is adopted.

The Cross-Border Dimension

The Barrier: UK freight operators do not operate solely within UK borders. International haulage requires vehicles and infrastructure to work across the EU.

Charging standards, payment systems, and regulatory frameworks need to align with EU equivalents, or UK operators face additional complexity and cost when operating internationally.

Accountability:

Current owner: DfT (for UK policy alignment), EU regulatory bodies (for EU standards).

Accountability gap: Post-Brexit, UK standards development can diverge from EU. For some sectors this creates opportunities for regulatory innovation. For freight, it creates friction and complexity.

Impact: UK operators face two sets of standards if UK and EU diverge. Vehicle specifications may need to accommodate both markets. Charging infrastructure may need dual compatibility. Payment systems must work across borders.

For an industry with tight margins, any additional complexity or cost is a competitive disadvantage.

What is needed: Active coordination to maintain alignment where alignment serves operator interests. This does not mean automatic adoption of all EU standards, but it does mean explicit consideration of international operational requirements when developing UK policy.



The Education Dimension

What is missing:

Clear guidance for operators on:

- Which technologies are mature enough to invest in with confidence
- What level of interoperability to expect from suppliers
- What questions to ask when procuring vehicles and infrastructure
- How to future-proof investments against evolving standards

This is not about government picking winners. It is about providing clarity on the current state of standards development, highlighting where uncertainty exists, and helping operators make informed risk assessments.

Accountability:

Current owner: No one. Industry bodies provide some guidance, but it is fragmented and often focused on promoting specific technologies rather than providing neutral assessment.

Accountability gap: Operators are expected to navigate complex technical standards without support, while making multi-year capital commitments based on incomplete information.

Impact: Risk-averse operators delay decisions due to uncertainty. Less sophisticated operators may make poor technology choices due to lack of guidance. The transition slows not because technology is unavailable, but because operators lack confidence to commit.



From the roundtable discussion:



It's an education set of standards that we might all adhere to that sort of define the market.

Standards are not just technical specifications. They are shared expectations about what constitutes good practice, what level of interoperability is reasonable to expect, and how different components of the system should work together.

The Core Standards Program

The barrier is not that standards do not exist. It is that the standards environment is evolving faster than operators can track, standards are being developed in multiple forums with incomplete coordination, and there is no authoritative source of guidance on which standards matter for which use cases.

Market standardisation will eventually resolve this. But eventually is not soon enough for operators making decisions now.

What is needed: Not mandated standards (which would be inflexible and potentially counterproductive), but:

1. Visibility: A clear map of which standards are settled, which are still evolving, and where operators face genuine uncertainty

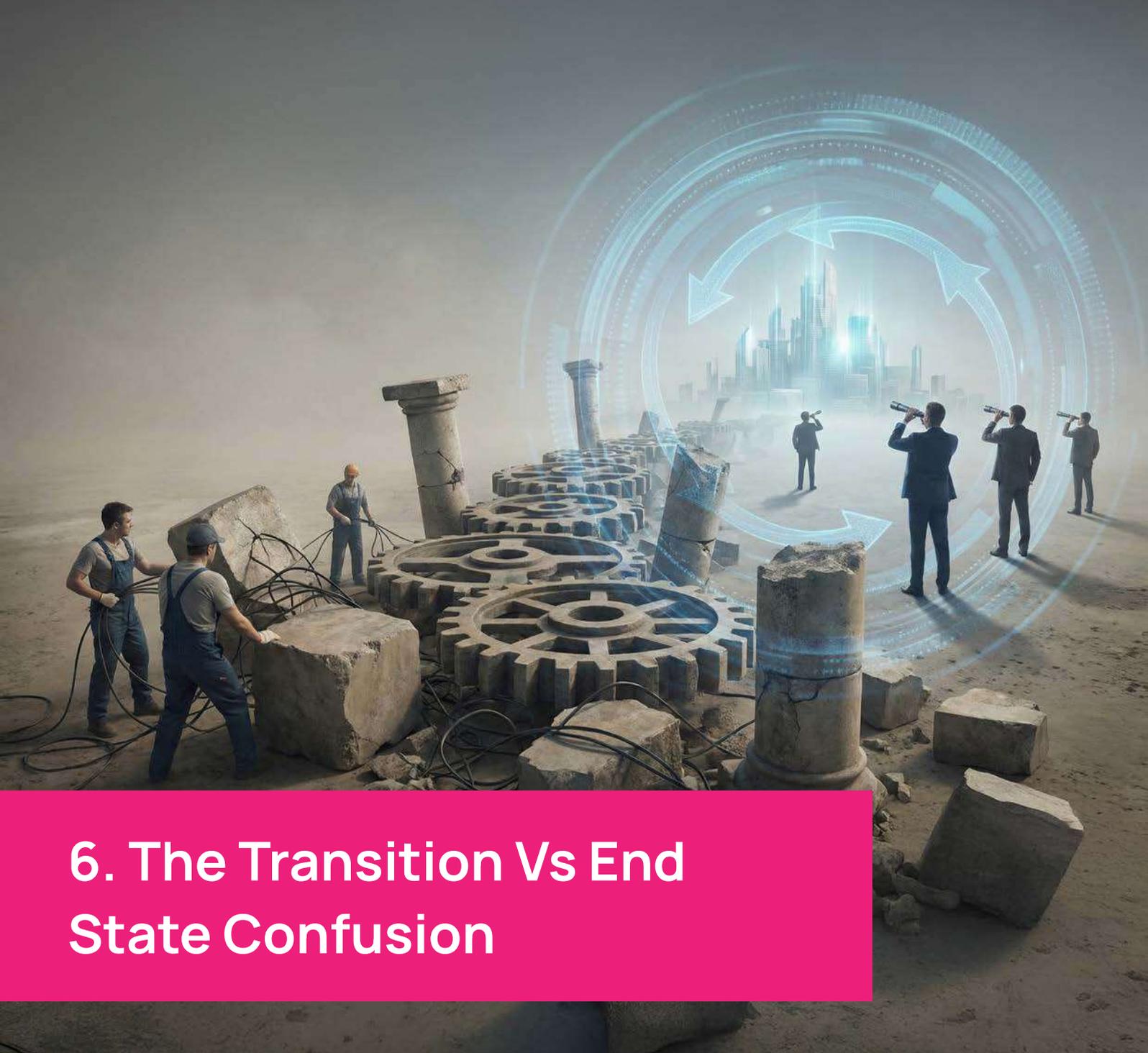
2. Coordination: Mechanisms for standards bodies, OEMs, infrastructure providers, and operators to coordinate development and adoption timelines

3. Guidance: Neutral, authoritative advice on technology maturity and interoperability expectations

4. Data sharing: Mechanisms for operators to share operational data to inform standards development without exposing commercial positions

None of this requires new regulation. It requires coordination infrastructure that currently does not exist.





6. The Transition Vs End State Confusion

A pattern emerged repeatedly throughout the 12 Pillars roundtable: attempts to discuss the ideal 2040 end state kept collapsing back into immediate transition problems. This was not a failure of facilitation. It reveals something fundamental about the coordination challenge.

Operators cannot meaningfully engage with end state discussions when they are facing immediate barriers that prevent them from taking the first step. Policymakers struggle to design transition support when they are focused on the final destination rather than the messy path to get there.

This section explores why this confusion matters, what it reveals about the gaps in transition planning, and why solving it is critical to making progress.

The Pattern

Session 2 of the roundtable was designed to focus on the end state: what does a functioning zero-emission freight system look like in 2040?

There was strong consensus on the vision:

- Seamless charging, always plugged in somewhere
- No queuing, no booking, no thinking about fuelling
- Automated payment integrated into fleet management systems
- Consistent vehicle designs and charging infrastructure
- Adequate capacity that any parking space could have charging available

For operators:

Discussing 2040 feels abstract when the immediate question is "which charging standard should I install in 2025?" or "how do I get planning permission for my depot?" The end state does not help with these decisions. In fact, it can make them harder by highlighting how far current reality is from the ideal.

Why This Matters

The inability to separate end state from transition is not a communication problem. It is a signal that the transition path is either unclear or non-existent.

For policymakers and system planners:

Focus on the end state can lead to solutions that work in 2040 but are not deployable now. Technologies that should exist in the end state (like vehicle-to-grid) become part of transition planning even though the prerequisites are not in place.

The gap:

What is missing is a transition roadmap that explicitly distinguishes between:

- What we are building towards (end state)
- What we need in the interim (transition solutions)
- When and how we shift from interim to end state solutions

Without this distinction, every discussion collapses into confusion about timeframes, feasibility, and priorities.

From the roundtable discussion:



We're all talking 2040, but I've got huge problem for 2035.

Another participant: "We need to ground back in reality before discussing technologies like vehicle-to-grid that depend on infrastructure and business models that do not yet exist."

Booking Systems

Booking systems for charging infrastructure illustrate the problem clearly.

Current reality: With limited public charging infrastructure, booking systems allow operators to guarantee access. They work when numbers are small and capacity is constrained.

End state: In 2040, with adequate infrastructure deployed, booking should be unnecessary. Vehicles charge wherever they park. Capacity is sufficient that advance planning is not required.

The transition problem: If booking systems are temporary, when and how do we transition away from them? If operators build operational processes around booking, how do those processes evolve? If technology providers build platforms to support booking, what is their business model in the end state?

These questions are not being addressed. The risk is that booking systems become embedded, not because they are optimal, but because no one planned the transition away from them.

From the roundtable discussion:



Booking systems are a short-time problem solution. They shouldn't exist in 2040.

What this reveals: Lack of intentional transition design. The assumption is that moving from current state to end state happens naturally as infrastructure scales. But it does not. Operational processes, technology platforms, business models, and operator behaviours all need to evolve in coordinated ways.

Without active management of this evolution, interim solutions persist beyond their useful life, creating inefficiency and lock-in.

The screenshot shows a user interface for booking a truck. At the top, it displays 'Scania R500 V8' with a license plate 'ABC-1234' and '80% Battery'. Below this is a 'Switch Vehicle' button and an image of the truck. The next section is 'SELECT DATE', featuring a calendar for 'October 2023' with the 5th highlighted. Below the calendar is 'AVAILABLE SLOTS (1H)', showing three time slots: '09:00' (Selected), '10:00' (Available), and '11:00' (Available). At the bottom, a summary box shows 'ESTIMATED COST' of '€42.50' and 'DURATION' of '60 mins'.

The V2G Example

Vehicle-to-grid (V2G) technology allows vehicles to return electricity to the grid when not in use, providing grid balancing services and potentially generating revenue for operators.

In the 2040 end state discussion, V2G was raised as a potential component of the system. But the discussion quickly stalled.

Why V2G is an end state technology:

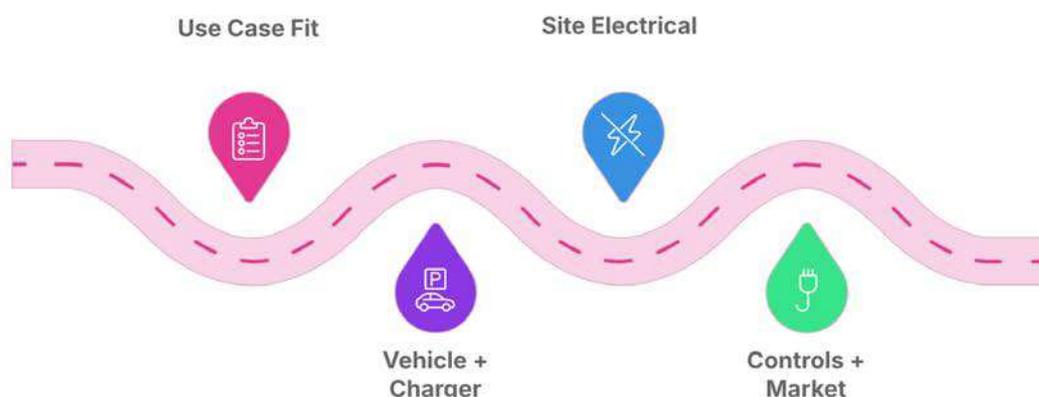
It requires:

- Large numbers of vehicles with bidirectional charging capability
- Aggregation platforms to coordinate vehicle availability with grid needs
- Commercial frameworks for compensating vehicle owners
- Grid infrastructure capable of accepting distributed generation
- Operational flexibility in fleet management to allow vehicles to discharge

Few of these prerequisites exist today. For an operator facing 2025 technology decisions, V2G is not relevant. It distracts from immediate challenges rather than helping solve them.

The confusion: Discussing V2G in a transition planning context sends mixed signals. It suggests operators should consider it when procuring vehicles and infrastructure. But for most operators, this is premature. The technology may be ready in a lab, but the system it depends on is not.

What is needed: Clear signalling about which technologies are relevant for near-term decisions and which are end state considerations. Operators need to know: "this is something to plan for in five years" versus "this is something to monitor but not act on yet."



From the roundtable:



We need to ground back in reality. There are many challenges before V2G is relevant.

The 2035 Problem Revisited

The 26-ton rigid vehicle deadline in 2035 illustrates another dimension of transition vs end state confusion.

2035 is neither immediate nor end state. It is squarely in the transition period. But it is being treated as neither.

It is not being addressed in immediate transition planning because it is seven years away, which feels distant to operators making near-term decisions.

It is not part of end state discussions because 2035 is before the 2040 end state and involves different vehicle categories.

The result: a deadline exists in legislation, but no one is actively working on the transition plan for it.

What this reveals: Transition planning is missing the middle ground. Immediate challenges (2025-2027) are being addressed reactively as operators encounter them. The 2040 end state is being discussed aspirationally. But the decade in between (2030-2040) has no clear transition roadmap.

This is where multiple vehicle categories need to transition, where infrastructure needs to scale from hundreds to thousands of sites, where standards need to settle, and where operational models need to evolve. It is the critical period, and it is the least well planned.

From the roundtable:



Nobody is talking about it.



Why Operators Cannot Engage with End State Discussions

When an operator is facing an immediate barrier, discussing the 2040 ideal feels like a luxury they cannot afford.

Example: An operator needs to install charging at their depot. They face:

- Uncertain technology standards (Section 2)
- Landlord who may refuse permission (Section 3)
- DNO connection process with unpredictable timeline (Section 4)
- Vehicle procurement with 18-month lead time (Section 2)

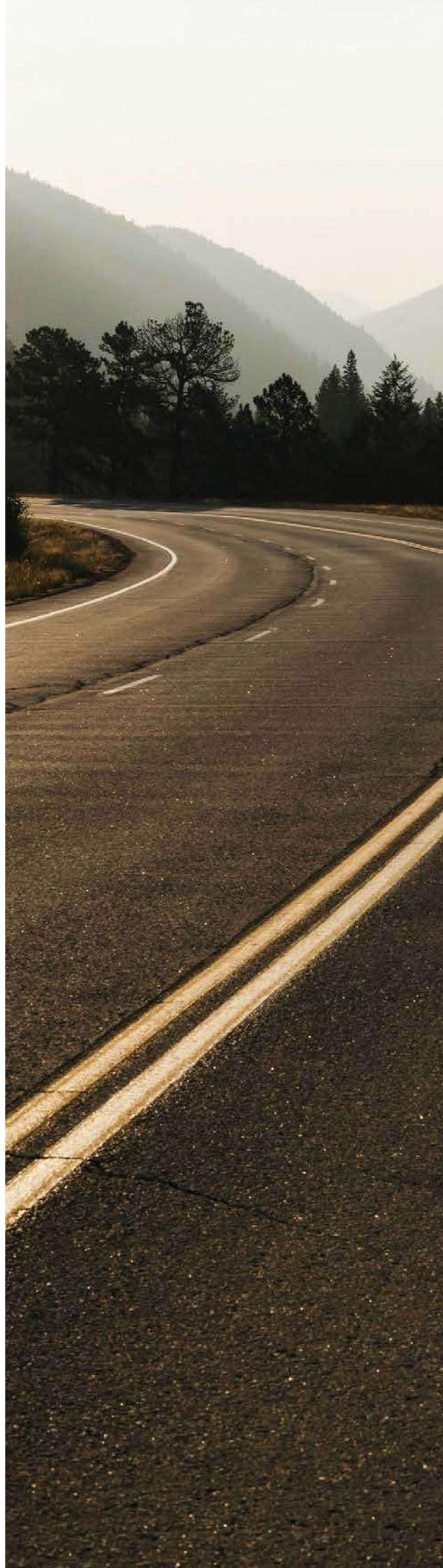
Asking this operator to engage with "what does seamless charging look like in 2040?" is asking them to look past the immediate barriers to an aspirational future. It is not that they do not care about the end state. It is that the end state does not help them navigate the present.

What operators need:

Practical transition guidance:

- Which technology choices are safe bets for 2025 deployment?
- What interim solutions are acceptable and will not create later problems?
- How do I plan infrastructure that works now but can evolve later?
- What decisions am I making now that constrain future options?

End state vision is valuable for setting direction. But it does not substitute for transition planning.



The Policy Dimension

Policy focus on end state targets without transition roadmaps creates its own problems.

Example: Setting a 2040 target for zero-emission freight is necessary. It creates direction and urgency. But without a transition roadmap, it leaves operators to interpret what that means for decisions made in 2025.

Should they wait for technology to mature?
Should they invest now in current technology?
Should they plan for interim solutions or commit to end state technologies that may not be fully deployable yet?

Different operators will interpret this differently, resulting in fragmented approaches and suboptimal outcomes.

What is missing: Transition milestones that sit between current state and 2040 end state:

- By 2027: technology standards settled for first-generation deployments
- By 2030: public infrastructure at sufficient density for long-haul viability
- By 2033: second-generation technology available for operators who waited
- By 2035: 26-ton rigid category transitioned
- By 2037: infrastructure at scale to support mass transition

These are not targets in the sense of legal obligations. They are planning milestones that help operators sequence decisions and give system actors (DNOs, CPOs, OEMs) visibility of expected demand curves.



Intentional Transition Design

The core insight from the roundtable's difficulty in separating transition from end state is this: transition does not happen automatically. It requires deliberate design.

What intentional transition design includes:

- 1. Explicit identification of interim solutions:** Technologies, processes, or business models that are needed now but should not persist to 2040.
- 2. Planned obsolescence:** Understanding when and how interim solutions will be phased out.
- 3. Evolution pathways:** How operators move from current practices to end state practices without disrupting operations.
- 4. Coordination of phase changes:** Ensuring that when one part of the system evolves (for instance, infrastructure), dependent parts (operational processes, technology platforms) can evolve in sync.
- 5. Protection against lock-in:** Ensuring that decisions made today do not constrain future options unnecessarily.

Accountability:

Current owner: No one. Individual actors are managing their own transitions, but the system-level transition is not being coordinated.

Accountability gap: No body responsible for transition design across the ecosystem. Policy sets end state targets. Market actors make individual decisions. But the coordination layer is absent.

Impact: Suboptimal transition. Higher costs. Delayed adoption. Persistent inefficiencies. Risk that interim solutions become permanent through inertia rather than design.

What This Section Reveals

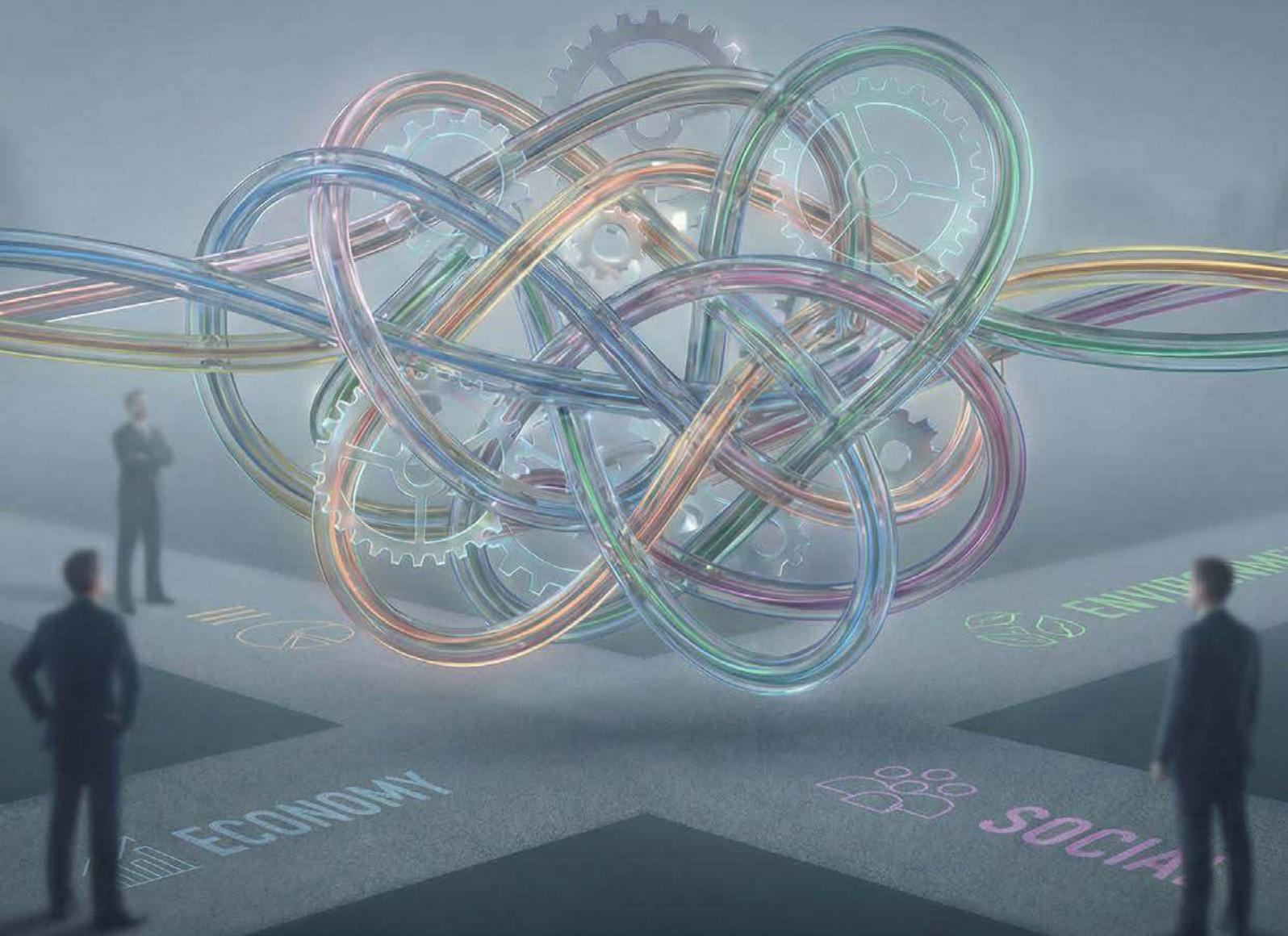
The difficulty in separating transition from end state discussions is not a facilitation problem. It is diagnostic.

It reveals that:

- Operators are facing immediate barriers that make end state discussion feel irrelevant
- The transition path is either unclear or non-existent in many areas
- The decade between 2030 and 2040 has inadequate planning
- Interim solutions are being deployed without clarity on how they evolve
- No one owns the coordination of system-level transition

Solving this requires more than just better meeting management. It requires intentional transition roadmap design that bridges current reality and future aspiration with practical, sequenced steps.

Without that, conversations will continue to collapse into confusion between "what should exist eventually" and "what I need to do next week."



7. Cross-Cutting Coordination Failures

Some barriers do not fit neatly into single categories. They sit at the intersection of multiple policy areas, affect multiple stakeholders, and require coordination between parties who do not naturally coordinate.

This section addresses the barriers that exist precisely because no single actor owns them, and because the systems designed to address them operate in isolation from each other.

The Driver Shortage and Infrastructure Opportunity

The Barrier: The UK freight sector faces a significant driver shortage.

Simultaneously, it needs to build thousands of charging hubs over the next decade. These two challenges could be addressed together, but they are being treated as separate problems.

Why this matters:

Charging infrastructure requires:

- Security (lighting, cameras, fencing)
- Weather protection (canopies, shelters)
- Power supply and communications
- Land and construction

Driver welfare requires:

- Secure parking facilities
- Showers and changing facilities
- Rest areas
- Safe, well-lit environments

The infrastructure requirements overlap significantly. Building charging hubs provides an opportunity to address driver welfare simultaneously, at marginal additional cost compared to addressing them separately.

The driver shortage context: The UK freight sector struggles to recruit and retain drivers, particularly women.

Working conditions, including inadequate facilities at depots and service areas, are a contributing factor. Women are particularly underrepresented partly due to lack of safe, clean facilities.

Addressing this is both a workforce issue and an industry sustainability issue. The transition to zero-emission freight will fail if there are insufficient drivers to operate the vehicles.

Why This is not happening

Accountability:

Transport decarbonisation: Owned by DfT, focused on emissions reduction, infrastructure deployment, vehicle technology.

Driver welfare and recruitment: Owned by Department for Work and Pensions, industry bodies, and individual employers. Focused on working conditions, training, and recruitment.

These are separate policy streams. Funding mechanisms are separate. Design standards are separate. Planning processes are separate.

From the roundtable discussion:



There's a lack of drivers, especially women. Charging hubs need facilities anyway - cameras for security. Build showers, kit drying, safe environments. Kill two birds. Create the future environment you would like drivers to be in.

Accountability gap: No mechanism for joining these conversations. Charging infrastructure funding does not consider driver welfare as an eligible cost. Driver welfare initiatives do not coordinate with infrastructure deployment timelines.

The property and planning system treats "vehicle charging infrastructure" and "driver facilities" as separate use classes with separate planning considerations.

Impact: Charging hubs are being designed and built as pure electrical infrastructure. Driver facilities, where they are provided, are added separately at additional cost. The opportunity to integrate them is being missed.

What Integration Would Look Like

A charging hub designed with driver welfare integrated from the start would include:

- Secure, well-lit parking with CCTV (needed for charging infrastructure anyway)
- Weather-protected charging bays (improves reliability and user experience)
- Clean toilet and shower facilities (marginal cost when utilities already being installed)
- Rest areas with WiFi (communications infrastructure already present)
- Food and beverage facilities (commercial opportunity for site operators)
- Safe walking routes between parking and facilities

This is not a radical redesign. It is designing charging infrastructure as places where drivers will spend time, rather than as purely technical installations.

Accountability gap: No design standards or funding mechanisms that default to this integrated approach. Each element is treated as optional rather than essential.

What is needed: Charging hub design standards that include driver facilities as baseline requirements, not optional enhancements. Funding mechanisms that support the full facility, recognising that addressing driver welfare is essential to transition success.

Policy coordination between transport decarbonisation and workforce initiatives, so that infrastructure deployment actively contributes to solving the driver shortage rather than ignoring it.



Cyber Security: The Unaddressed Risk

The Barrier: Zero-emission freight requires digital connectivity between vehicles, charging infrastructure, payment systems, fleet management platforms, and grid operators. This connectivity creates cybersecurity vulnerabilities that are not being systematically addressed.



What the risk includes:

- Vehicle systems vulnerable to remote access or manipulation
- Charging infrastructure vulnerable to disruption or malicious control
- Payment systems vulnerable to fraud or data theft
- Fleet management platforms vulnerable to operational disruption
- Grid connections vulnerable to exploitation for grid destabilisation

Poland was cited as an example where transport operations have been deliberately targeted digitally. The UK freight sector, as it becomes increasingly digitalised and connected, faces similar risks.

Why This Is Critical

A successful cyberattack on freight infrastructure could:

- Disable vehicles at scale, disrupting supply chains
- Compromise safety systems, creating physical danger
- Manipulate charging systems to damage batteries or create fire risk
- Disrupt payment systems, preventing drivers from charging
- Provide access to operational data, compromising commercial confidentiality
- Destabilise local grid networks through coordinated charging manipulation

These are not theoretical risks. The increasing digitalisation of transport, energy, and payment systems creates attack surfaces that hostile actors can exploit.

From the roundtable discussion:



We haven't talked about cybersecurity. We're opening up a whole attack front here. It's been exposed in Poland already where they've been deliberately targeting transport operations digitally.

Accountability:

Current owner: Fragmented across multiple parties, each responsible for their own systems but not for system-level security.

- Vehicle manufacturers secure their vehicles
- Charging infrastructure providers secure their systems
- Payment providers secure their platforms
- Fleet operators secure their management systems
- Grid operators secure their networks

Each does this independently, with no coordinated approach to system-level vulnerabilities.

Accountability gap: No body responsible for assessing system-level cybersecurity risks in zero-emission freight. No coordinated approach to setting security standards. No mechanism for sharing threat intelligence across the sector.

The National Cyber Security Centre (NCSC) provides guidance, but this is generic. Sector-specific risks and mitigations are not being systematically addressed.

Why This Was Not Discussed in Depth

Cybersecurity was raised at the end of the roundtable, almost as an afterthought. It received acknowledgment but not detailed discussion.

This is revealing. Cybersecurity is recognised as important, but it sits outside the core concerns of operators focused on immediate barriers like grid connections, planning permission, and technology choices.

The problem: Cybersecurity cannot be retrofitted effectively. It needs to be built into systems from the start. If it is not being discussed in transition planning now, it will become a crisis later.

What is needed:

- Sector-specific cybersecurity standards for zero-emission freight
- Coordinated threat intelligence sharing across operators, infrastructure providers, and OEMs
- Security-by-design requirements for charging infrastructure and vehicle connectivity
- Incident response protocols that work across multiple parties
- Regular security assessments of system-level vulnerabilities

Accountability gap: No one has been assigned responsibility for leading this work. It is sitting in the gap between multiple actors who each assume someone else is handling it.



The Communications and Confidence Problem

The Barrier: Public and political discourse frames infrastructure investment as "spending" that must be justified against competing priorities. This makes it difficult for government to commit to the scale of investment required for transition.

The challenge:

Infrastructure investment in zero-emission freight:

- Reduces future costs (fuel, carbon, air quality health impacts)
- Enables economic activity (freight movement supports all sectors)
- Creates economic opportunities (new industries, jobs, exports)
- Delivers multiple benefits (decarbonisation, air quality, energy system flexibility)

But it is communicated and perceived as cost, not investment. This makes it politically difficult to commit the required funding, particularly when balanced against immediate spending priorities like healthcare or education.

Why this matters:

Operators need confidence that infrastructure will be delivered to support their transition. If government cannot credibly commit to infrastructure funding because it is framed as discretionary spending rather than essential investment, operators face continued uncertainty.

Accountability:

Current owner: Government communications, shaped by Treasury accounting frameworks and political discourse.

Accountability gap: No coherent narrative that reframes infrastructure as investment rather than cost. Industry voices may understand this framing, but have limited ability to influence public and political discourse.



From the roundtable:



How do we help government with their communication around what might be seen as an investment and taking money from one pot to another, when in reality it might not be that way?

What is needed:

Industry support for government in communicating the investment case. This includes:

- Evidence of economic returns from infrastructure investment
- Demonstration of cost savings versus alternative scenarios
- Articulation of wider benefits beyond emissions reduction
- Comparison with international competitors who are investing

This is not just a government communications problem. It is a coordination problem between government and industry to develop and deliver consistent messaging that builds public and political support for necessary investment.



Learning from Countries Doing It Well

The Barrier: Some countries are further ahead in zero-emission freight transition. They have addressed barriers, developed working solutions, and demonstrated what success looks like. But there is no systematic process for learning from them and adapting their approaches to UK context.

Why this matters: Other countries have already encountered and solved problems that the UK is now facing:

- Norway: high adoption rates, charging infrastructure deployment, business model innovation
- Netherlands: urban freight logistics, integration with planning systems
- California: regulatory frameworks, incentive mechanisms, zero-emission zones

Learning from these examples could accelerate UK transition and avoid repeating mistakes.

Accountability:

Current owner: Individual actors (operators, OEMs, infrastructure providers) learn from international counterparts through commercial relationships and industry networks.

Accountability gap: No systematic process for identifying international best practice, assessing transferability to UK context, and adapting successful approaches.

Government trade missions and policy exchanges occur, but lessons learned do not consistently translate into UK policy or industry practice.

What is needed:

Structured international engagement programme that:

- Identifies leading jurisdictions and specific successes
- Assesses which approaches are transferable to UK context
- Facilitates knowledge exchange between UK and international operators
- Incorporates lessons into UK policy and industry guidance
- Maintains ongoing relationships to share evolving practice

This should not be government-only. Operators, infrastructure providers, and industry bodies should be involved in international learning and adaptation.

From the roundtable:



We should reference those countries that are doing it well and better than us, and we should engage them.

Creating Certainty Through Process

The Barrier: Operators need confidence to invest, even in the absence of complete certainty about technology, policy, and infrastructure.

What a roadmap provides:

- **Visibility** of major decision points and their timing
- **Clarity** on who is responsible for what
- **Shared understanding** of interdependencies
- **Milestones** that allow progress tracking
- **Flexibility** to adapt while maintaining direction

Why this matters:

From Section 6, operators cannot meaningfully plan when they do not know whether the decisions they make today will be supported by infrastructure, policy, and technology developments tomorrow.

A roadmap does not guarantee specific outcomes, but it provides a structure for managing uncertainty. It shifts the conversation from "what will happen?" to "what are we collectively trying to make happen, and how do we coordinate to achieve it?"

Accountability:

Current owner: No one. Various actors are developing plans, but there is no overarching roadmap that connects them.

Accountability gap: No body responsible for convening the ecosystem to develop a shared roadmap. No mechanism for maintaining and updating it as circumstances change.

What is needed:

Not a government-dictated roadmap (which would lack industry buy-in and operational realism), but an industry-led roadmap developed in collaboration with government and other stakeholders.

From the roundtable:



We talked about the creation of the roadmap to build confidence and to help the education need.

A roadmap does not remove uncertainty. Technology will continue to evolve. Policy will adapt. Market conditions will change. But a roadmap makes the transition path visible, creates shared expectations, and provides a framework for coordinating decisions across multiple actors.

This roadmap would:

- Be operator-centric, reflecting real operational requirements
- Identify critical path dependencies between actors
- Highlight barriers that need addressing and by whom
- Provide milestones for technology, infrastructure, and policy development
- Be living document, updated as circumstances evolve

The process of creating the roadmap may be as valuable as the roadmap itself, by forcing conversations about coordination and accountability that are not currently happening.



The Pattern of Coordination Failures

The common thread across all cross-cutting barriers is the absence of coordination mechanisms.

Driver welfare and infrastructure deployment sit in separate policy streams with no bridge between them.

Cybersecurity is everyone's problem and therefore no one's priority. Infrastructure investment communication requires coordinated industry and government messaging that is not happening. International learning is ad hoc rather than systematic. Roadmap development has no clear owner.

These are not problems that individual operators can solve. They are not problems that government can solve in isolation. They require coordination infrastructure that currently does not exist.

What coordination infrastructure means:

- Forums where cross-cutting issues are discussed
- Mechanisms for sharing information across sector boundaries
- Processes for identifying and addressing gaps in accountability
- Resources to support coordination activity
- Authority to convene relevant parties and drive action

Some of this exists informally through industry bodies and government engagement. But it is not sufficient for the scale of coordination required for transition.

Accountability:

Current owner: No one owns the coordination infrastructure itself.

Accountability gap: The meta-problem. No one is responsible for ensuring that coordination mechanisms exist and function effectively.

Impact: Cross-cutting problems persist because they fall between the gaps of existing structures. Each actor addresses their piece, but no one joins the pieces together.





8. Operator Realities and Constraints

Before concluding, it is necessary to return to the people this transition affects most directly: the operators making decisions under uncertainty, carrying commercial risk, and living with the consequences of policies designed by others.

The barriers documented in this report are not abstract policy problems. They are daily operational realities for people trying to run businesses, meet customer commitments, and navigate a transition they did not choose but cannot avoid.

From the roundtable discussion:



***None of us have a roadmap yet.
But recognising the problem is halfway to solving the problem.***

This statement captures both the challenge and the opportunity. Operators are clear-eyed about the scale of what faces them. They are not in denial. They are not resistant. They are uncertain about how to proceed because the path is not clear.

This is not operator failure. It is system failure. The transition framework does not yet exist in a form that allows operators to plan with confidence.

From the roundtable discussion:



This decade, we came in one way, we're going out completely different.

The pace of change is unprecedented in the freight sector. An operator who began this decade with a fully diesel fleet, established operational patterns, and predictable technology refresh cycles now faces complete transformation of their business model.

This is not hyperbole. The technology changes. The fuel changes. The infrastructure changes. The operational patterns change. The regulatory environment changes. The customer expectations change. All simultaneously.

No other sector transition has asked operators to absorb this much change this quickly while maintaining service continuity and commercial viability.

From the roundtable discussion:



That's what truck operators do - we wait until the last minute.

This statement, also from the roundtable, is often interpreted as reluctance or resistance. It is neither.

It is rational economic behaviour in a capital-intensive sector with thin margins.

Truck operators cannot afford to invest early in depreciating assets. Cash flow does not permit it. Early adopters carry technology risk that may not pay off. Waiting until necessity forces action is not stubbornness. It is survival.

But this rational individual behaviour creates a collective problem. If all operators wait, the system cannot deliver at the required pace.

The coordination challenge: How do you encourage early adoption without penalising those who do it? How do you prevent late rush without forcing premature investment?

This is not solved by exhortation. It requires incentive structures that make early adoption economically rational, or mechanisms that spread the transition curve to prevent system overload.

"My Entire Family Life Is on the Line"

This comment, about technology choices and the risk of backing the wrong standard, is easy to dismiss as dramatic. It is not.

For small and medium operators, business failure is personal catastrophe. There is no corporate parent to absorb losses. No diversified portfolio to balance risk. The business is often the family asset, built over generations.

Making a wrong technology bet does not mean reduced profit. It means insolvency.

Policy discussions often abstract this away. "The market will adapt. Operators will transition." But behind each operator is a person or family carrying existential risk.

This does not mean policy should not push transition. It means policy must recognise the stakes for those being asked to act.

From the roundtable discussion:



We all know that industry makes better, more astute business decisions than government.

This is true, but incomplete.

Industry makes better operational decisions because it has better operational data and understands commercial realities that policy does not capture.

But industry cannot make coordinated system-level decisions. It cannot set standards that all must follow. It cannot build infrastructure where the business case is insufficient but the public interest is clear. It cannot mandate the coordination that prevents suboptimal individual choices creating system failure.

The transition requires both. Industry decisions grounded in operational reality, and policy frameworks that enable coordination and address market failures.

Neither can do this alone. The 12 Pillars roundtable demonstrated what happens when they try to work together: difficult conversations, but productive ones. Disagreement, but respect. Recognition that each brings something the other needs.

The View from the Depot

Put yourself in the position of a fleet operator today:

You know you must transition to zero-emission vehicles. The deadline exists. Customer pressure is building. You want to do it.

You investigate options. You discover:

- Multiple competing technologies, no clarity on which will win
- Grid connection required, timeline uncertain, cost unknown
- Planning permission needed, outcome unpredictable
- Landlord permission if you lease, which you do
- Long vehicle lead, if available at all for your use case
- Charging infrastructure must be specified before vehicles ordered, but compatibility uncertain
- Public charging for long-haul operations inadequate
- Total cost of ownership calculations depend on electricity price volatility
- Government policy signals intent but provides limited implementation detail
- Industry bodies offer guidance but cannot provide certainty

You have capital to invest. You want to move. But every decision point reveals dependencies on factors outside your control.

So you wait. Not because you are resistant. Because moving forward requires navigating complexity that your business does not have resources to manage, and making bets with consequences you cannot afford to get wrong.

This is the operator reality. And this is what the barriers documented in this report are doing. Not preventing transition in absolute terms, but making it so complex, risky, and uncertain that rational economic actors cannot proceed with confidence.



What Operators Need

From the roundtable discussions, operators articulated what they need clearly:

Not certainty. They understand uncertainty exists and always will.

Not solutions. They can develop solutions if the framework is clear.

Not subsidies alone. While funding helps, it does not overcome the barriers documented in this report.

What they need:

- 1. Visibility.** Of standards development, infrastructure plans, policy timelines, and technology maturity.
- 2. Coordination.** So that vehicle procurement, infrastructure deployment, and grid connections can happen in sequence without multi-year delays.
- 3. Acknowledgment.** Of barriers that cannot be immediately fixed, so they can plan around them rather than being surprised by them.
- 4. Process clarity.** Understanding which regulatory changes are possible and on what timeline.
- 5. A roadmap.** Not government-dictated, but industry-led with government participation. A shared view of the path forward that allows coordinated action.

None of this is unreasonable. None of it is asking for special treatment. It is asking for the coordination infrastructure that makes complex system transitions possible.

The Confidence Gap

The central operator need is confidence. Not certainty, but confidence that:

- Decisions made today will be supported by infrastructure tomorrow
- Investment in technology will not be stranded by standards evolution
- Regulatory environment will evolve predictably even if the specific changes are uncertain
- When problems arise, there are mechanisms to address them
- They are not alone in navigating this transition

Confidence comes from visibility, process clarity, and coordination. It comes from seeing that the system is being actively managed, not just allowed to evolve chaotically.

The current state does not provide this confidence. And without confidence, rational operators delay. The transition slows not because of opposition, but because of absence of the conditions that enable action.



9. Conclusion

This report has mapped the barrier landscape for zero-emission freight transition from the perspective of those experiencing it: operators, infrastructure providers, and adjacent sectors.

It has identified barriers across seven categories:

- Time pressures and decision-making windows
- Non-financial regulatory and legislative obstacles
- Infrastructure coordination challenges
- Market standards and interoperability gaps
- Transition versus end state confusion
- Cross-cutting coordination failures
- Accountability gaps across the system

It has established that many of these barriers persist not because they are difficult to solve technically, but because accountability for solving them is unclear or absent.

It has documented that the transition is failing not due to lack of technology, lack of capital, or operator resistance, but due to absence of the coordination infrastructure that makes complex system transitions possible.

The Core Finding

The transition to zero-emission freight is fundamentally a coordination problem.

Individual actors are largely doing what they should:

- Operators are making cautious but rational decisions under uncertainty
- OEMs are developing vehicles and ramping production
- Infrastructure providers are deploying charging capacity where business case exists
- Government is setting policy direction and providing some funding support
- DNOs are responding to connection requests

But these individual actions are not coordinated. Each party is optimising for their own constraints without visibility of what others are doing or what the system needs.

The result is predictable: suboptimal outcomes, duplicated effort, missed opportunities, delays, and persistent barriers that no single actor can address alone.

The barrier is not individual actors failing to act. The barrier is the absence of mechanisms to coordinate their actions.



A critical caveat: Identifying accountability gaps is necessary but not sufficient. This report maps where responsibility sits and where gaps exist, but mapping alone does not create change. The parties identified as current or potential owners must take ownership, not just acknowledge the barriers, but commit resources, authority, and attention to addressing them.

Some barriers documented in this report have been known for years but persist because no party has actively claimed responsibility for solving them. Others have theoretical owners who lack either the mandate, resources, or cross-sector authority to act effectively. Making gaps visible creates the possibility of action but does not guarantee it.

The test of this report's value will be whether it prompts actual ownership, whether the parties identified here step forward to address barriers within their remit, or whether the gaps remain mapped but unaddressed.

The Three Patterns

Stepping back from individual issues, three recurring patterns become visible across the barrier landscape:

Pattern 1:

Known problems with no clear owner. Many barriers are well understood but no party has responsibility for addressing them. They persist not through ignorance but through absence of accountability.

Pattern 2:

Distributed ownership without coordination. Many barriers have multiple owners, each addressing their piece, but with no mechanism for coordinating across boundaries. Individual competence does not create system effectiveness without coordination.

Pattern 3:

Policy and delivery gaps. Policy sets direction without delivery mechanisms. End state targets exist without transition roadmaps. Intent exists without implementation processes.

All three patterns point to the same underlying problem: coordination infrastructure is missing.

What Coordination Infrastructure Means

Coordination infrastructure is not bureaucracy. It is the mechanisms that allow multiple independent actors to align their actions without central control.

It includes:

- Information sharing mechanisms that make visible what each party is planning, allowing others to adjust their plans accordingly.
- Forums for cross-sector dialogue where parties who do not naturally coordinate can discuss interdependencies and resolve conflicts.
- Processes for identifying and addressing accountability gaps rather than assuming someone else is handling them.
- Standards and frameworks that create shared expectations without mandating specific technologies.
- Roadmaps and milestones that provide waypoints for collective progress without dictating individual paths.
- Data-sharing mechanisms that allow operational reality to inform policy without exposing commercial positions.
- Authority to convene relevant parties and drive action when coordination is needed but not happening organically.

Some of this exists informally. Industry bodies provide forums. Government conducts stakeholder engagement. Commercial relationships create information flows.

But it is not sufficient for the scale of coordination required. The informal mechanisms are being overwhelmed by the complexity and pace of transition.



Who Builds the Roadmap?

Throughout this report, the need for a roadmap has been a recurring theme. Not a government-dictated plan, but an industry-led roadmap developed in collaboration with government and other stakeholders.

This raises an obvious question: who does this?

The answer cannot be "government alone."

Government can convene, facilitate, and participate. But government does not have the operational data, commercial insight, or delivery capacity to build the roadmap unilaterally. The result would lack buy-in and operational realism.

The answer cannot be "industry alone." Industry lacks the authority to commit policy changes, infrastructure investment, or regulatory adaptation. An industry-only roadmap would be a wish list, not a delivery plan.

The answer must be "together." An industry-led process with government participation, or a government-convened process with industry leadership. The exact structure matters less than the principle: both must be genuinely engaged, both must contribute, both must commit to the outcome.

This requires trust that has not always existed. Government trusts that industry will not use the process simply to delay or to seek advantage. Industry trusts that government will not use the process to impose predetermined solutions.

The 12 Pillars roundtable demonstrated that this trust can be built. Not through agreement on everything, but through honest conversation about barriers, constraints, and what each party can and cannot deliver.



Next Steps

This report does not prescribe next steps in detail.

But some next steps follow logically from the findings:

Immediate:

1. **Prioritisation.** Not all barriers are equally urgent. Some must be addressed immediately to prevent near-term paralysis. Others can be managed over longer timeframes. Operators and policymakers should jointly identify which barriers are on the critical path.
2. **Quick wins.** Some barriers can be addressed rapidly with minimal cost. Acknowledgment of axle weight issues costs nothing but provides confidence. Publication of grid capacity data requires DNO action but not legislation. Identifying and actioning quick wins builds momentum.

Near-term:

4. **Accountability assignment.** For each barrier with no clear owner, assign one. For barriers with distributed ownership, establish coordination mechanisms. Make it explicit who is responsible for what.
5. **2035 transition programme.** The forgotten deadline for 26-ton rigids needs immediate attention. Convene the relevant parties, assess requirements, and develop a delivery plan before it becomes a crisis.
6. **Data-sharing mechanism.** Establish trusted intermediary to aggregate operational data from operators in way that informs policy without exposing commercial positions. This could be structured through industry bodies or academic partners.

Medium-term:

7. **Roadmap development.** Convene industry-led process to develop transition roadmap with government participation. Set milestones for technology, infrastructure, and policy. Create visibility and coordination framework.
8. **International learning programme.** Structure systematic engagement with countries ahead of UK to identify transferable lessons and avoid repeatable mistakes.
9. **Coordination infrastructure.** Establish the forums, processes, and mechanisms that enable ongoing coordination. Not a new bureaucracy, but deliberate investment in coordination capability.

These are not recommendations in the traditional sense. They are the logical implications of the barriers and accountability gaps documented in this report. If the barriers are real, and if the accountability gaps are genuine, then these next steps follow necessarily.

The barriers documented here point clearly to what is needed:

- Visibility where there is currently opacity
- Coordination where there is currently fragmentation
- Accountability where there is currently diffusion
- Pathway where there is currently only destination
- Operator voice where there is currently prescription

This report deliberately avoids prescribing solutions. The solutions will be operator-led, grounded in commercial reality, and adapted to UK context. They will not be perfect, and they will evolve as circumstances change. But they will not emerge at all without the coordination infrastructure to enable them.

The Roadmap Is Not the Destination

The goal is not to create the perfect roadmap. The goal is to create the conditions under which operators can transition with confidence, infrastructure can be deployed efficiently, and the system can adapt as technology and circumstances evolve.

The measure of success is not adherence to the roadmap. The measure of success is whether the roadmap enables operators to act.



If operators remain paralysed by uncertainty, if infrastructure deployment is chaotic, if barriers persist unaddressed, if transition stalls despite available technology and capital, then the roadmap has failed regardless of how comprehensive it looks on paper.

The Invitation Stands

The 12 Pillars manifesto concluded with an invitation: "If you work in freight - or in any of the systems that surround it - this is your invitation to contribute."

That invitation remains open. This report is not the end of the conversation. It is documentation of the conversation's beginning.

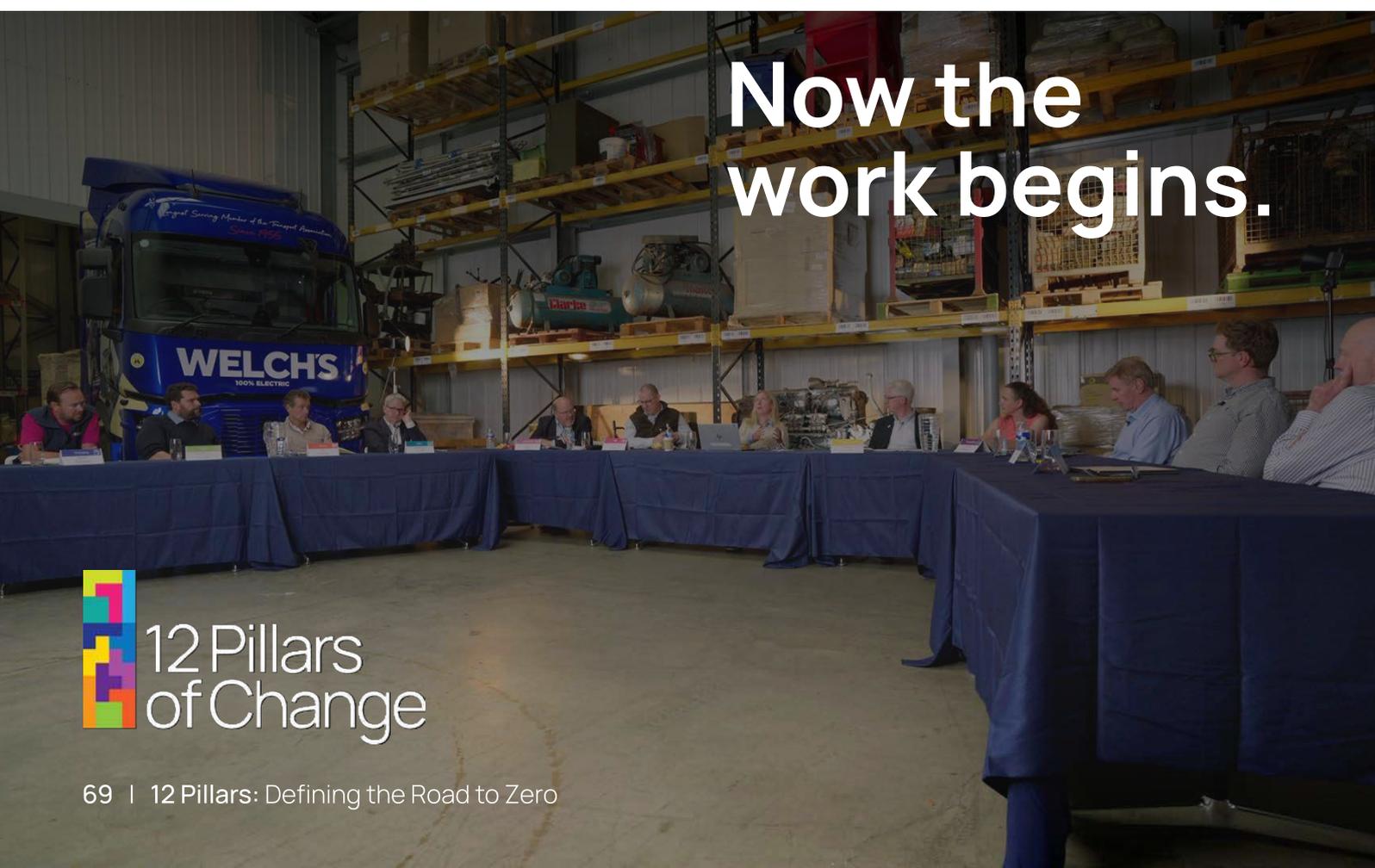
None of this happens without continued engagement from operators, infrastructure providers, policymakers, OEMs, energy companies, property sector, and all the adjacent parties whose decisions affect transition success.

The roundtable was limited to twelve voices. But the conversation is not.

Use this report. Challenge it. Correct it where it is wrong. Build on it where it is right. Hold it to account.

Because the path to zero-emission freight will not be found by waiting for answers. It will be built by the industry itself, informed by documents like this but driven by operational reality and commercial necessity.

The barriers are mapped. The accountability gaps are identified. The questions are framed.



Now the work begins.

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