Digital Metro Ambitions Need Critical Connectivity

Paul Davison, CEO and Founder of PPWD, on complexity, cooperation and the specialist skills Britain now needs

The United Kingdom's railway stands once again at a moment of structural inflection. With the gradual move toward Great British Railways and the unwinding of the franchising arrangements that have shaped the industry since the early 1990s, track, train and station are slowly being drawn back toward a closer organisational relationship under the strategic oversight of the Department for Transport. For some observers this feels like a long-overdue correction to fragmentation. For others it introduces understandable uncertainty. For everyone involved in the industry it represents the most consequential structural shift in a generation.

Yet structural diagrams are the easy part. Organisational charts can be redrawn in weeks. Governance frameworks can be negotiated over months. But cultures that have evolved separately for more than thirty years do not simply merge because a policy document suggests that they should.

History is not kind here to large organisational integrations undertaken with optimism but without humility. When institutions with distinct professional identities combine, the resulting culture rarely selects the best elements of each predecessor. More often it drifts toward the most defensive behaviours already present in the system. The habits that protect individuals from blame, simplify accountability and prioritise measurable targets over shared understanding.

Rail does not have the luxury of learning these lessons slowly. Unlike many industries, the railway cannot pause while it reorganises itself. The system remains live, interdependent and unforgiving. Trains continue to move at speed while governance reforms are debated. Infrastructure continues to age, passengers continue to travel and operational decisions continue to be made in real time. Reintegration therefore presents a challenge that is not merely structural. It is a challenge of complex system stewardship while the system itself remains in motion.

It may be tempting to treat reintegration as a complicated problem. One might believe that with sufficient programme management discipline, regulatory clarity and technical expertise the variables can be analysed, controlled and ultimately stabilised. That logic works well for complicated systems where cause and effect relationships are largely predictable and where solutions can be engineered through expertise. But the railway, particularly during a period of structural transition, is not merely complicated. Rather, it is complex.

Complex systems behave differently from complicated ones. Their outcomes are shaped not simply by components but by relationships. They are characterised by non-linear interactions, emergent behaviour and sensitivity to context. Small shifts in communication patterns can produce disproportionate consequences. Informal norms can dampen risk or amplify it. Local decisions, perfectly reasonable within their own domains, can interact with other decisions in ways that no individual actor intended or could have foreseen.

In such environments outcomes cannot be engineered solely through command structures or compliance regimes. They emerge from the quality of relationships within the system. From shared understanding, adaptive capacity and the willingness of people to exchange information across boundaries. For three decades the railway has been organised around those boundaries. Train Operating Companies and infrastructure management have developed under different incentive structures, different rhythms of decision making and different professional identities. Operators have been shaped by revenue risk, punctuality metrics, passenger satisfaction scores and the commercial obligations embedded within franchise agreements. Infrastructure management has been shaped by regulatory control periods, asset stewardship requirements and engineering reliability frameworks.

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These differences were not superficial. They influenced language, priorities and patterns of thought. They shaped how risk was interpreted and how success was defined. The delay attribution regime, with its financial penalties and compensation mechanisms, unintentionally reinforced these divisions. When performance faltered, accountability often became transactional rather than collaborative. Financial consequences were assigned. Responsibility was negotiated. The system functioned, but cooperation often occurred in the shadow of contractual tension.

Over time those habits became normalised. Reintegration now asks these communities to operate as a unified system. Yet cultures that have spent decades developing separate reflexes do not simply dissolve when instructed to collaborate. They must be consciously, thoughtfully and artfully re-woven. The history of Britain's railway already reminds us of what can happen when organisational fragmentation, ambiguous responsibilities and misaligned oversight combine. The accidents at Southall in 1997 and Ladbroke Grove in 1999 are often described through the technical details of signals passed at danger, maintenance shortfalls, and infrastructure design.

Yet their deeper significance lies elsewhere. Both accidents revealed systemic weaknesses at organisational interfaces. Places where responsibilities overlapped, where assumptions about competence were made across institutional boundaries and where communication drift allowed risk to accumulate unnoticed. These events were not the product of isolated human error. They emerged from the interaction of multiple reasonable decisions made within a fragmented system.

That recognition transformed modern safety thinking in rail. The creation of the RSSB and RAIB were a direct consequence of those accidents, as investigations increasingly shifted away from individual blame toward systemic understanding. Governance and regulatory oversight were strengthened, and attention turned toward how organisational structures, incentives and communication patterns shape operational reality. Improved driver training followed, alongside the integration of human factors understanding and complementary non-technical skills.

Reintegration therefore presents both an opportunity and a risk. The opportunity lies in reducing the structural fragmentation that once obscured shared responsibility. The risk lies in assuming that structural integration alone will automatically produce cultural integration. It will not. Yet alongside this structural reform sits a familiar expectation: that the railway must also become more innovative.

A further tension sits quietly beneath the language of reform: the expectation that the railway must become more innovative. Innovation, by definition, requires organisations to attempt something new or novel, to explore ideas whose consequences cannot yet be fully known. Yet the railway is a system that has been deliberately shaped over generations to do the opposite. Its professionalism has been built around the disciplined application of established rules, procedures and standards, many of which were written in the shadow of previous accidents.

Organisational theorist James March described this tension as the balance between exploitation and exploration. Exploitation refines and strengthens what is already known to work. Exploration searches for what might work next. Safety-critical industries understandably favour the former, because reliability protects lives. But periods of structural reform inevitably introduce pressure for the latter. The challenge therefore is not whether the railway should innovate, but how it can explore carefully without undermining the disciplined practices that have made it safe. The railway ought not innovate in the manner of software companies. Instead evolving, cautiously, deliberately and in full view of the consequences of getting it wrong.

Over the same thirty years that rail governance fragmented, the industry itself also became more distributed. Many of the capabilities once held within British Rail, the design, manufacturing, instructional, maintenance specialisms and technical services, are now embedded within a wide ecosystem of contractors, suppliers and joint ventures.

The modern railway is therefore not a single organisation but a networked industrial system.

Reintegration at the centre does not remove that distributed reality. If anything, it makes it more visible. Interfaces between operators, infrastructure managers, suppliers and specialist service providers remain central to performance and safety. Knowledge flows across organisational boundaries. Operational risk frequently resides in the spaces between formal responsibilities rather than within them.

Successful reintegration must therefore extend beyond former track-train boundaries. It must cultivate cooperation across the wider industrial network that sustains the railway's daily operation. This is why the GBR reform programme increasingly resembles what scholars describe as a wicked problem.

Wicked problems have no definitive formulation. Each attempt to solve one aspect of the problem alters the conditions surrounding it. Stakeholders hold legitimate but competing priorities, cost efficiency, passenger experience, workforce stability, political accountability, safety assurance and infrastructure renewal. There is no moment at which one can confidently declare the problem solved. In such systems leadership must shift from solution delivery to adaptive stewardship.

The question becomes less about implementing a single correct structure and more about sustaining the relationships that allow the system to adapt safely as conditions change. Interestingly, examples of such governance already exist. For centuries the Netherlands has faced a challenge that is structurally different but conceptually similar: how to coordinate large numbers of people to manage a system that cannot be paused and where failure has catastrophic consequences.

This is a result of much of the country residing below sea level, protected by polders. The reclaimed land surrounded by dykes that must be constantly maintained to prevent flooding.

Flood defence in the Netherlands has never been governed purely through central command. Instead, it evolved through what became known as the Polder Model, a tradition of consensus-based cooperation in which government authorities, engineers, landowners, municipalities and citizens negotiate shared responsibility for managing water.

The logic behind the model is simple and pragmatic. If the dykes fail, everyone floods. Therefore, decisions about water management must be made collectively, drawing on local knowledge, technical expertise and shared accountability. Over time this cooperative ethos became embedded not only in water management but also in Dutch economic and political culture. It reflects an understanding that complex systems, whether hydrological or industrial, cannot be governed effectively through hierarchy alone. They require continuous dialogue across institutional boundaries.

I offer that the UK's rail reintegration requires a similar mindset. The railway cannot be governed solely through reporting lines that run vertically between operators and central authorities. It requires lateral communication between disciplines and diagonal communication across professional hierarchies. Engineers, operators, controllers, maintainers and suppliers must all develop the ability to see beyond the limits of their own domains and understand the wider system within which they operate.

In the language of human factors this capacity is known as shared situational awareness. Non-technical skills are often discussed at the level of the individual: a driver maintaining awareness of signals, a signaller communicating clearly with adjacent control areas, or a controller making disciplined operational decisions under pressure. Yet non-technical skills also exist at team and organisational levels. Shared situational awareness across a reintegrated railway requires people to exchange information beyond inherited silos. It requires vertical communication up and down organisational hierarchies, lateral communication between functional teams and diagonal communication that cuts through traditional reporting structures.

For some parts of the industry this will feel unfamiliar. Headquarters functions accustomed to stable reporting cascades may need to become comfortable with more fluid patterns of information exchange. Specialists who have spent decades refining expertise within bounded domains may need to translate their knowledge into language that others can use. This is not a dilution of expertise. It is its expansion.

In complex systems timely decision-making depends not simply on authority

but on distributed understanding. If shared situational awareness fails to extend across historical track-train boundaries, local optimisation may quietly undermine system coherence. Communication therefore becomes a risk control. Psychological safety becomes operational infrastructure. If individuals feel unable to speak about emerging concerns because they fear blame or reputational damage, the system loses one of its most important early warning mechanisms. Conversely, when reporting is treated as an act of professional commitment rather than disloyalty, weak signals of emerging risk can surface before they escalate into failure.

A compassionate approach to safety reinforces this perspective. Compassion in this context does not mean lowering standards or excusing poor performance. It means approaching operational challenges with disciplined curiosity about the conditions under which people work. It recognises that frontline workers often possess tacit knowledge of system fragility that formal governance structures cannot easily detect. Humans in complex systems are not the weak link. They are the adaptive capacity that allows imperfect designs to function safely under variable conditions.

Reintegration will succeed only if the people closest to the work experience genuine ownership of the change. If integration is perceived as imposed from above, compliance may be achieved but engagement will not. If integration is co-created, shared responsibility can emerge. The specialist capabilities required for this next chapter of Britain's railway therefore extend well beyond technical expertise.

Systems thinking becomes indispensable, and the ability to perceive how decisions

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in one domain influence performance elsewhere, becomes a necessity. Human factors literacy must become mainstream so that workload, fatigue, cognitive demand and communication design are understood as performance variables rather than afterthoughts.

Cultural integration capability must also be cultivated. Leaders and practitioners alike must learn to translate between professional dialects, aligning engineering priorities, operational realities and policy expectations into a shared narrative of system performance. The very learning itself must evolve. This is because, in complex environments the conditions that produce failure are often the same conditions that normally produce success. Therefore, understanding everyday work. How tasks are actually performed rather than how procedures imagine them, becomes central to prevention. Establishing and nurturing a culture of learning becomes key to achieving this.

For example, learning-oriented investigation methods, such as learning reviews, offer one pathway for cultivating this understanding. By focusing on how people navigate operational pressures and constraints, they reveal the adaptive practices that allow the railway to function reliably in practice.

Reintegration offers an opportunity to extend such learning across historical boundaries, replacing adversarial reflexes with shared inquiry. Yet the transition itself carries risk. Periods of structural uncertainty increase cognitive load. Increased cognitive load raises the probability of error. Informal safety nets that once existed within established organisational cultures may weaken before new ones have matured. So unless reporting channels are protected, dialogue intensified and wellbeing treated as a meaningful leading indicator of system health, reform may inadvertently create fragility before new structures and their stability have had time to emerge.

The opportunity, however, is equally real. A genuinely integrated railway could align incentives toward whole-system optimisation, reduce the transactional friction created by fragmented governance and build a more coherent architecture for learning and improvement. But structure alone will not deliver that outcome.

Integration diagrams can be drawn quickly, but the shared understanding to go with it takes much longer. Over three decades the railway has developed separate institutional memories, professional languages and operational reflexes. Each organisation has learned to optimise its own part of the system. Reintegration now asks something more demanding: the ability to see the railway again as a single, living system. This matters not simply for efficiency or governance, but for safety itself.

Railway safety has never been the product of rules alone. It emerges from the quality of understanding distributed across the system. The degree to which engineers, operators, controllers, maintainers and leaders are able to anticipate how decisions made in one place will shape conditions somewhere else. Compliance can confirm that procedures were followed yesterday. However, what will keep the railway safe tomorrow is the system’s capacity to recognise weak signals, adapt collectively and respond before small misalignments compound and accumulate into failure.

In that sense, safety is less a static condition, rather it is more a dynamic property of cooperation. Safety in complex systems rarely emerges from rules alone. It arises from the quality of attention distributed across the system. The degree to which people are able to notice small signals, question assumptions and adapt collectively as conditions change. Research into what are known as high reliability organisations, studied by scholars such as Karl Weick and Kathleen Sutcliffe, shows that the safest systems are not those that rely solely on procedural compliance, but those that cultivate a form of organisational mindfulness: a shared attentiveness to how work is actually unfolding. In such environments, expertise is allowed to travel to where it is needed, communication flows across traditional boundaries and small anomalies are treated as valuable signals rather than inconvenient noise. Safety in this sense becomes less a static condition enforced by rules and more a dynamic property of cooperation.

The specialists who will shape the success of Great British Railways will therefore not be defined solely by technical mastery. They will be the individuals capable of thinking across organisational boundaries, communicating diagonally as well as vertically, and sustaining cooperation where competition once existed. Shared situational awareness in such an environment is not a cognitive luxury but a form of risk control.

They will also understand that psychological safety is not a cultural embellishment but operational infrastructure, because a railway that does not demonstrate respect for each other’s area of responsibility or does not provide permission for those undertaking the reality of work to question, will deny the individual, team and organisational level learning required to quickly adapt to remain safe.

Additionally, all of what I have described must occur while the railway continues to run. Unlike many industries, the system cannot pause while it reorganises itself. The trains keep moving, passengers keep travelling, the weather erodes and the infrastructure continues to age, adapt and respond to the pressures placed upon it.

Reform therefore cannot simply be imposed from the top of an organisational chart. It must be carried through the living network of people who operate, maintain and understand the railway every day. The task is not to override that expertise, but to connect it; vertically, laterally and diagonally. So that insight moves across the system with the same continuity and reliability that we expect of the trains themselves. The innovation employed in such a safety-critical system cannot mean abandoning established knowledge in pursuit of novelty. It must instead mean something more careful: the disciplined extension of existing understanding. And that in turn requires a particular kind of professional capability.

If reintegration succeeds, it will not be because the structure was redesigned. It will be because the railway rediscovered how to learn and think as a system again.

Because in a railway that never stops moving, safety is not created by organisational charts. It is created by people, by their willingness to share what they see, question what they do not understand and connect their expertise with others across the system.

When that happens, understanding begins to flow across the railway as reliably as the trains themselves.

And in the end, it is that human connection, more than any structure, that will keep the system safe. RP

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