

# Project leadership: Getting Crossrail back on track

## Background

In 2018 it was announced that the Crossrail programme could not be delivered to the original timescale and budget. The project sponsors made changes to the Board and Executive in response. This paper describes the leadership lessons learned in resetting the project in 2019–2020 and discusses the broader implications for leading complex major programmes.





# 1 Introduction

---

**Author:**



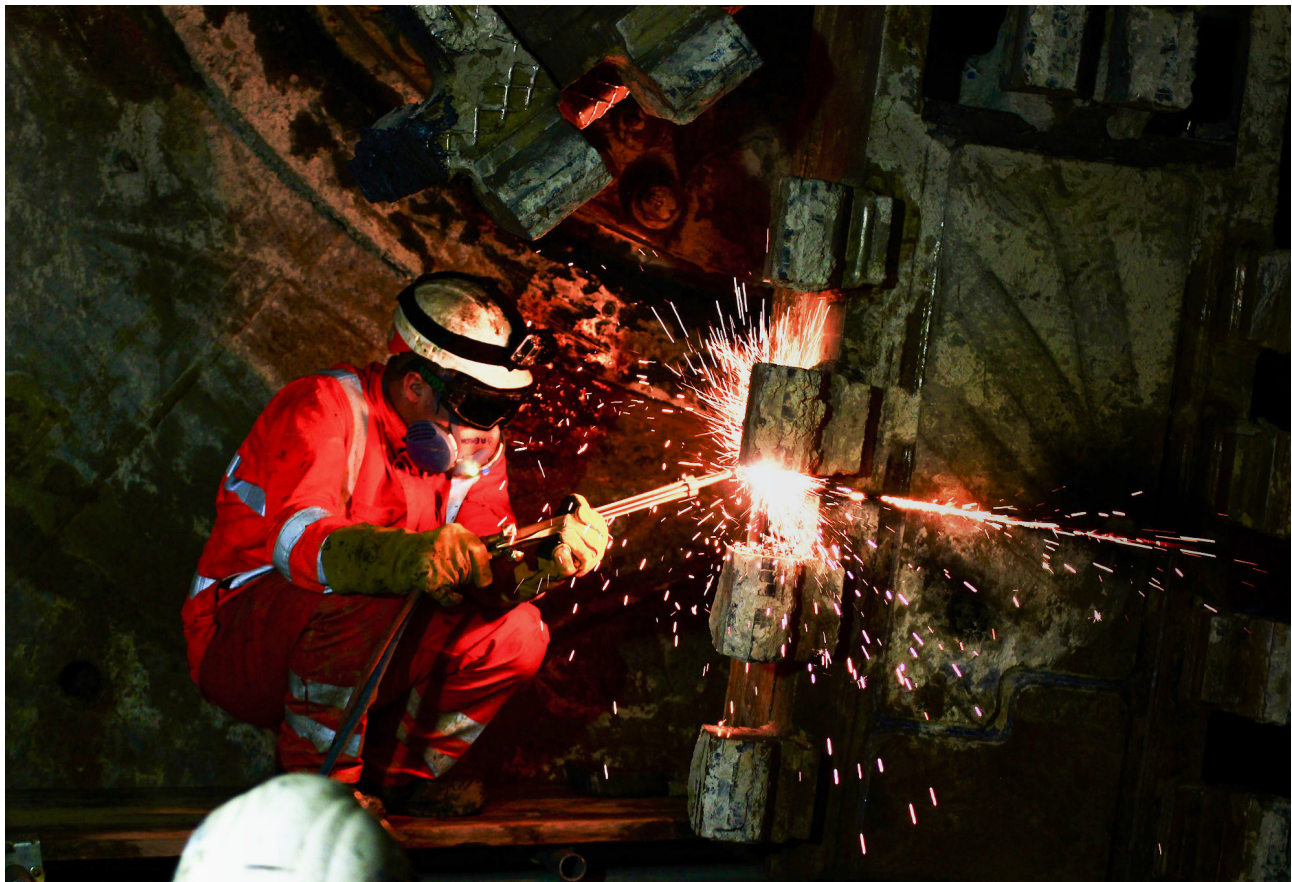
**Mark Wild OBE**

Chief Executive  
Officer, Crossrail,  
2018–2022

Crossrail is an east-west combined metro/suburban rail system running under London, linking Reading in the west with Shenfield in the east. It runs for more than 100km, including 42km of new tunnels beneath London. After many years of planning and approvals, project implementation began in 2009. The project is now approaching completion, passenger services on the Central Section began on 24 May 2022 and the full service will be introduced by May 2023.

Crossrail is recognised as one of the most complex infrastructure projects in Europe, and for many years represented the gold standard in terms of transport project implementation. The complex civil engineering task of creating 42km of tunnel and 20 new underground structures, beneath one of the oldest and most populated cities in the world, has been widely and justly celebrated as an extraordinary feat of engineering.

However, not everything progressed entirely according to plan. The Central Section, almost entirely underground between Paddington and Abbey Wood, was scheduled to open in December 2018. In August 2018, just four months before the long-planned opening date, it was announced that the opening would be delayed – this came as a real shock to all stakeholders. The unexpected announcement at such a late stage created a total breakdown in confidence and trust between the project organisation and the sponsors and stakeholders. It also created a major hiatus in the progress of the project, as leadership and governance changes were made, and new plans developed to complete the railway. This paper captures some of the leadership lessons learned in the process of resetting the project and putting it ‘back on track’.



# 2 The challenge of leading Crossrail

---

The aspiration to create an east-west railway corridor across London was first mooted in the first half of the 19<sup>th</sup> century, as a means of connecting the canals of the Paddington basin to the docks in the Thames Estuary in the east. In modern times, the programme that we recognise as Crossrail today first appeared on the proposed rail map in 1974. After several false starts, serious planning for the current programme commenced in 2001, a Bill was introduced in 2005 and Royal Assent was achieved in 2008.

Creating this new underground railway was always going to be an ambitious and uncertain endeavour. There are several reasons for this.

- The great majority of the proposed alignment was beneath London at a depth of 25–40m. London is one of the most difficult cities in the world to achieve this tunnelling drive, with 2,000 years of archaeological history, crossing the River Thames, large multistorey buildings with deep foundations and of course navigating a labyrinthine existing deep tube system.
- The construction of 20 huge vertical structures, nine storeys deep in the ground in a congested, busy megacity.
- The aspiration for an entirely digital railway, set at a time when the technology was immature or did not exist at all.
- The world's most complex railway signalling system, with a high degree of required research and development.
- Significant and extensive connection and interface with the existing classic networks of Network Rail and London Underground.

For these reasons, the construction of Crossrail, and its ultimate integration into a high-capacity railway for 250 million customers per year, was always going to be a very difficult leadership challenge.

This paper focuses on the lessons from Crossrail's challenges and is written in the spirit of helping and aiding future leadership of megaprogrammes like this one. In doing so, it's natural to focus on what went wrong. This is not to take away from or deny any of the huge and remarkable achievements of the leadership teams throughout the long history of the Crossrail programme.

# 3 The leadership route to unreality

Throughout the construction period, from the very start of construction in 2009 to the declaration in mid-2018 that the opening of the line at the end of that year would not be possible, the Crossrail programme was seen by all as a well-run programme; one that was 'on time and on budget'. The failure of the programme in 2018 came as a significant shock and surprise to those on the outside of the programme.

In reality, the programme had been under increasing time pressure from the time of completion of the tunnel drives, which had largely been completed successfully, overcoming many significant challenges.

However, slippage of the major civil engineering work, together with a total commitment to retain the Central Section opening date of December 2018, led to increasing compression of the all-important work of integrating, testing and assuring millions of individual components into an integrated whole – creating a functioning railway. While Crossrail had the theoretical system architecture in place to deliver the final product, there was insufficient understanding of the effort required to knit the whole system together, and therefore no real understanding of how long it would take – and how much it would cost. In fact, it took the new leadership team much of 2019 to build a complete understanding of everything that was required.

At the time of the programme declaring that the December 2018 opening date could not be met, the publicly declared completion status was 95%. Taking into account a realistic assessment of the remaining systems integration effort and the related risk, and a realistic assessment of how ready the completed elements were for that integration, that percentage should have been a great deal lower.

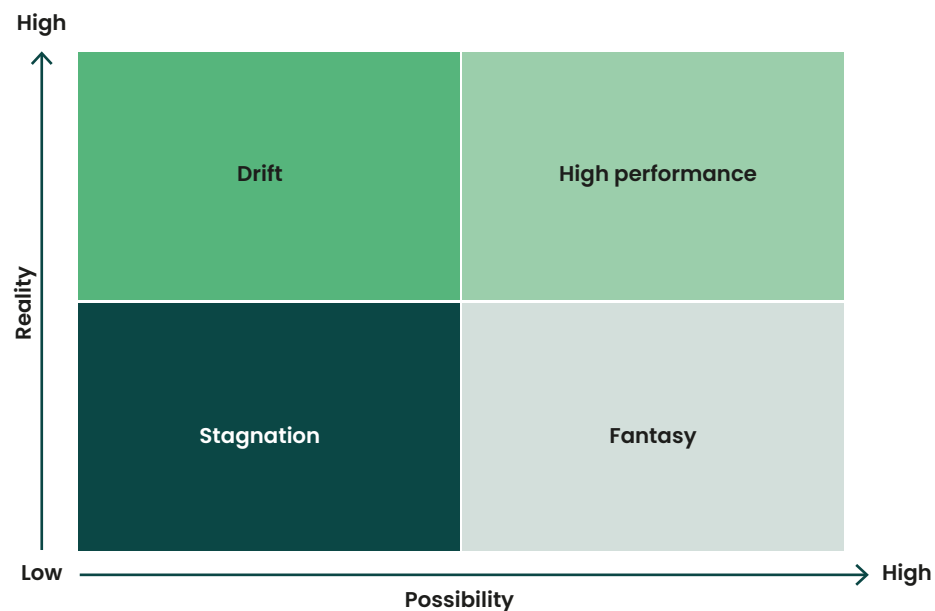


Figure 1 A performance model for complex programmes

**“The reasons for this catastrophic loss of situational awareness and reality were complex and multifaceted.”**

Between 2013 and 2018, the programme gradually lost sight of the effort that would be needed to complete the physical works and bring the integrated railway into use. The bold aspiration/ambition of opening the railway on 9 December 2018 remained the same, but clarity on the level of completeness reduced over time. The reasons for this catastrophic loss of situational awareness and reality were complex and multifaceted.

It's hard to understate the extent to which the deadline of 9 December 2018 started to distort behaviour in the project as the date approached. Slippage in civils was occurring throughout the project; the programme was rescheduled annually, but the end date never shifted. This led to massive compression of the complex integration and testing phases. A culture that had created success in the early days also led to blindness in the later stages – a can-do attitude disconnected from reality.

The information reaching the top became disconnected from the reality at the workface, with people telling management what they wanted to hear. This reinforced a confirmation bias that became pervasive.

Crossrail had become too autonomous. Continuous schedule revision obscured slippage of internal milestones. The schedule was updated annually, so was always 'on schedule'. Absolute commitment to an immovable end date and the can-do spirit of the project team led to poor visibility of project performance at board level.

There is no doubt that the leadership thought Crossrail overcame many, many complex challenges. The tremendous early success in particular and great publicity surrounding it seems to have created something 'untouchable', and possibly led to the lack of deep independent assurance of work in later years, which, with hindsight, was obvious.

The focus on an immovable singular end date seems to have created the conditions for reality to have been lost collectively from the Leadership team, the Board, the sponsors and, crucially, the scrutiny of the myriad assurance levels.

In one perspective of leadership, before 2019 it could be said that the glory and most of the pain on the programme happened as a product of localised vision.

- The focus on world-class civils produced award-winning work in the tunnelling.
- The focus on world-class design produced extraordinary individual elements (beautiful stations, first-in-class technology, etc.).
- The localised focus on the parts built a bow wave of increasing disaggregation between those parts.
- The failure of 2018 was a shortfall of holistic vision – for how the parts would actually all come together (integration) and work together (operability).

At the start of the recovery phase in early 2019, over 100 leaders within the Crossrail programme (including the supply chain) were interviewed individually to discover their perspectives. The overwhelming majority stated that they knew the programme would struggle to meet the December 2018 date, but could not see the whole, beyond their own component part.

# 4 Leading in complex major programmes

---

From the very start of Crossrail, the challenge faced by the Leadership team was very demanding indeed and full of uncertainty. In this section, we look at how the failure of 2018 could have been avoided.

## 4.1 End dates can be deadly

The adoption of a single fixed end date early in the Crossrail programme is the primary cause of the progressive loss of reality suffered by the Crossrail Board and Leadership team. This was further compounded by the adoption of this as one of the most important outcomes of the programme (the other being staying within the allocated budget). The 'on time and on budget' mantra became the amber that trapped those leading the programme.

If the Leadership team prior to 2019 were afforded the same benefit of planning outcomes in 'windows of uncertainty', as the post-2019 team could, it is the author's view that more thoughtful planning could have been evidenced. For example, the decision in 2014–2015 to proceed with detailed station M&E design before the client's design had reached a pre-agreed level of maturity might have had a different outcome had the concept of 'windows' been in play.

The management of the inevitable tension of pushing the internal team to early dates while maintaining the confidence of sponsors and stakeholders that the late dates will hold is the art of major programme management.

## 4.2 Owning the whole programme

In a project of this scale and complexity, the primary role of the client organisation is to integrate the activities of many parties. Experience shows that this cannot be left to the supply chain. During the construction phase, contractors working on different stations, for example, can afford to operate somewhat independently. As the project moves into the final phases of integration, ever-greater levels of co-ordination are required. Individual components are tested and verified; then components are integrated, tested and verified in sub-systems; sub-systems are integrated into systems; then many systems are brought together into an integrated operating railway.

This is challenging work, with many frustrations and setbacks along the way. It is vital that the Leadership team can create an environment of 'owning the whole', with a holistic view of all elements of the project and a one-team approach to problem-solving and resource allocation. It is quite literally the case that no one succeeds unless everyone succeeds – as every single piece of the jigsaw must fit together, safely. Completing programmes such as Crossrail are actually not a baton-pass-type race, more a 'Tough Mudder' obstacle course where all parties have to cross the line together.

One of the most critical and successful interventions in early 2019 was the creation of an integration team to bring together the train and signalling software. The very complex, first-of-a-kind software systems for trains and signalling were built by two separate vendors working largely independently. The integration team brought these elements together, co-ordinating and driving integration of the systems as multiple software iterations were developed and tested. In early 2019, software development was regarded as one of the biggest risks to project delivery. The integration team managed that risk and successfully delivered multiple iterations of the software to schedule.



### 4.3 Creating a culture of collaboration

Another important leadership intervention in 2019 was the creation of forums for collaboration between Crossrail and its key suppliers. It was essential to create a sense of common purpose among the supplier community, and to provide all suppliers with a clear sense of the whole. Again, the need for higher levels of co-ordination made it essential that each contractor was able to see where they fitted into the larger scheme, what the priorities were and how they could work together to solve problems. This intervention was very successful in shifting the productivity and momentum in the programme.

### 4.4 Reducing complexity and increasing co-ordination

Crossrail is more complex than it needs to be in almost every dimension, including multiple interfaces and dependencies between the 37 main works contractors and their lengthy (and common) supply chains. It comprises very complex technology, as evidenced by the uniquely complex train and signalling system. There are also substantial variations in detailed design station by station, even though the programme started with a very clear ethos of a kit of parts and commonality.

There was very limited use of conscious design modularity and use of off-site construction techniques (Design for Manufacture and Assembly, or DfMA). Far too much construction, testing and integration was done actually in the target infrastructure, often 30m below the streets of London by thousands of interdependent workers faced with very difficult access and logistical constraints.

In part, this was due to a complex procurement strategy with a huge number of contractor interfaces to manage. This was challenging throughout, particularly as the programme moved from construction to testing and integration.

Programmes such as Crossrail are inherently complex; undoubtedly decisions made by the programme had the effect of increasing the complexity. In this environment, as complexity increases, there is an ever-increasing need for the client organisation to co-ordinate and integrate activities. The commercial risk/reward framework needs to support and enable this requirement for client organisations such as Crossrail to become expert at co-ordination.

The technical assurance process deployed on Crossrail is, by necessity, complex and of a very large scale. Over 250,000 documents need to be completed to assure the new railway. While there is no doubt the assurance process could have been made more efficient, the key leadership challenge is to actually complete the work. Often this work completion is dependent on several co-dependent parties. Hence the absolute need for greatly increased off-site construction and assurance, and also a continuous and clear-eyed view of the actual extent of completeness.

## 4.5 Focus on the whole system design and implementation, not just civil engineering

One of the biggest challenges facing major infrastructure projects is the almost Victorian mindset that identifies infrastructure with civil engineering – Crossrail was a system integration programme, with civil engineering as a means to an end, not an end in itself. Crossrail is about delivering the Elizabeth line, a high-quality, safe, reliable, convenient operating railway – not about delivering a set of tunnels and stations. Plans for integration, testing and assurance were poorly understood and unrealistic. Most of the leadership, metrics and reporting were all construction focused, leading to the catastrophic result of vastly underestimating the effort required to bring the whole system together. The key is to genuinely consider the whole system throughout the entire life cycle – particularly at the key decision points. On Crossrail, this was compounded by the millstone of a single end date defined many years before.





# 5 Recovery

---

## 5.1 Building the new team

Towards the end of 2018, a largely new senior Leadership team was put in charge of Crossrail delivery. This was accompanied by a shakeup in governance, with additional sponsor-appointed Non-Executive Directors (NEDs) on the Board, together with a new Chair and Deputy Chair at the start of 2019. The speed with which the new team was put in place was admirable – nevertheless, there is no doubt that a great deal of momentum was lost as these changes were implemented, and as the new team started to create a new plan for completion of the railway.

While the new Leadership team functioned well in challenging circumstances, there were undoubtedly one or two leadership gaps that detracted from the overall performance of the organisation. These gaps were ultimately filled very successfully. But with the benefit of hindsight, we should have moved more quickly to get the correct balance of skills in the team – nothing is more important in the successful delivery of a project than the quality of the leadership. Recognising gaps and moving quickly to address them is vital.

The 2019 Leadership team did, however, gain broad alignment on a plan that mapped out all the parts *together*, and *mobilised* the programme teams to work inside a performance-managed time frame that identified connectivity between the individual parts.

In addition to new leadership, the organisation had to rebuild in several crucial areas. Optimism about the 2018 opening date had led to premature demobilisation of around 30% of the Crossrail organisation, including crucial disciplines such as project controls and risk management. Rebuilding this capability was a critical factor in the speed with which management was able to get the project back under full control.

## 5.2 Enrolling and activating the supply chain

One of the major dysfunctions on the Crossrail programme leading up to the 2018 problems was the gap in planning and forecasting between the supply chain and the client. The new Leadership team made a particular effort in bringing the supplier community together and enrolling them in owning the whole of the programme's success. This included having the Tier 1s and Tier 2s work more collaboratively, from holistic solutions to deploying scarce specialised resources. Some examples are listed below.

- Transforming the CRL/Siemens/Bombardier collaboration through establishing the 'plateau' approach, where the software 'mountain' was climbed together in small incremental steps but by remaining highly aligned at all times.
- Intervening in the conditions at Bond Street, a particularly challenging element of the programme, through increased alignment and collaboration with the Tier 1 contractor.
- Being clear on the priority and sequence of the entire programme, such that scarce resources at Tier 2 and Tier 3 could be deployed efficiently.

### 5.3 Rebuilding trust – openness and transparency

One of the major impacts of the missed deadline in 2018 was the total breakdown in trust between the sponsors, stakeholders and Crossrail Ltd. Rightly or wrongly, stakeholders felt badly let down, and in some cases seriously misled. It is not possible for an organisation to function effectively under such conditions, so a primary objective of the new leadership was to rebuild trust. In pursuit of this, the leadership team and the Board committed to a principal value of maximum openness and transparency. This was pursued through a variety of means, including frequent briefings of sponsors and stakeholders, publication of board minutes and Project Representative (P Rep) reports, face-to-face briefing of sponsors at the end of all board meetings, etc., but above all by exhibiting open and transparent behaviour: a willingness to share the bad news as well as the good, and to be open about the risks and uncertainties facing the programme. This is often very difficult, especially in a public setting where uncertainty is frequently construed as incompetence.

Of equal, if not greater, importance was the need to create trust within the Crossrail organisation itself. Establishing clear and transparent flows of information from the bottom of the organisation to the top was vital – this was something that had broken down in 2018. The leadership quickly initiated a visualisation board approach throughout the project, building a matrix of measurable performance indicators to establish progress, identify issues and blockages, and escalate problems as rapidly as possible. This was a critical early step that provided a structured approach to gathering data, tracking progress and solving problems in a uniform manner across all parts of the project. It was a significant step in building a holistic view of the whole project. It also created a shared language and process for performance management, which was a notable gap prior to 2019.



## 5.4 Rebuilding the plan

One of the most critical interventions at the beginning of 2019 was the creation of a new plan to complete the railway. The new team inherited a plan that was undeliverable, as it was not underpinned by a realistic understanding of the amount of work still to be done. In creating a new plan, known as the Earliest Opening Programme (EOP), the team developed a staged approach to the completion of various elements of the railway, such as the stations. This staged approach allowed vital activities, such as testing of trains and the signalling system, to be carried out before final completion of individual stations.

While the EOP provided a solid foundational logic for the final stages of the project, turning this logic into detailed cost and schedule estimates proved more challenging and took longer than anticipated.

In early 2019, the leadership and the Board were under considerable pressure (to some extent self-imposed) to announce revised cost and schedule estimates. Building on the learning from 2018, the Board elected to publish a range of dates (an opening window) and a range of costs, in recognition of the considerable risk and uncertainty that remained within the project. This was something of a novel approach at the time, but is now becoming well established in projects of this magnitude and complexity.

Despite what we thought at the time was a cautious approach, by publishing a range, initial estimates proved optimistic and had to be revised on two occasions. In early 2019 we had only a partial understanding of what was left to do, and a very incomplete understanding of the productivity we could achieve in the very complex and highly interdependent tasks remaining. A key lesson to be drawn from this experience was the need to resist pressure – whether actual or perceived – to make public statements before the level of information and analysis is sufficient to fully underpin the estimates. The longer-term loss of confidence from failing to meet expectations substantially outweighs the short-term benefit of satisfying stakeholder desire to know when the project will be complete.

Balancing the need for creating new timeline expectations in 2019 with the reality of how much was not understood and not 'see-able', in terms of integration and operability, was a key learning at this time.



# 6 Conclusions

---

Three key lessons have been distilled from the experience of completing Crossrail.

## 1 Systems thinking is essential

Perhaps the single biggest lesson from the Crossrail experience is the vital importance of seeing the system as a whole, and recognising that the primary delivery challenge of any large-scale infrastructure project today is not the civil or mechanical engineering, complex though that may be, but the integration of the whole system. For a long period, the primary emphasis of the project was on the extraordinary feats of civil engineering required to build beneath London. These were indeed exceptional accomplishments, well documented and justly praised.

## 2 Deadlines can be deadly

The fixation on an increasingly unachievable delivery date during 2018 provides another important lesson from the Crossrail experience. One that has already been distilled, reported and acted on by the Department for Transport and the Infrastructure and Projects Authority (DfT and IPA) in their report *Lessons from Transport for the Sponsorship of Major Projects*. While all projects need deadlines to create pace and momentum, total commitment to an unrealistic deadline can create an environment in which the reality of actual performance gets lost. The upward flow of information that contradicts the top-down imperative can be hampered, information is subconsciously shaped to support the prevailing narrative, and serious cognitive bias affects the ability of leaders to see reality and act accordingly.

It's not that there were deadlines, which are a fundamental component of almost every project. Rather, it was the single-minded adherence to deadlines without mapping them onto realistic views of progress – the lack of managing the tension between target and progress. That single-mindedness came from a perspective, either a lack of willingness to confront the objective indicators of insufficient progress or to confront the potential consequences of failing to meet very public objectives. That was failure of perspective and leadership.

Unfortunately, this experience during 2018 did not prevent the new Leadership team from also creating optimistic schedules in 2019, but it did lead to a massive effort to increase transparency in reporting, and to the introduction of the concept of target ranges for cost and schedule, rather than single-point estimates. Essential in this is for the authorising environment around the programme to encourage openness and transparency, and not to shoot the messenger.

## 3 Complexity kills

A third major lesson from Crossrail relates to complexity. Some degree of complexity is unavoidable in a project of the scope and scale of Crossrail. However, complexity carries enormous cost and creates high levels of risk. Decisions – technical, commercial and organisational – made early in the life of the project created a complex environment for project completion. A determined effort should be made in the conceptual design stages to simplify and standardise to the greatest possible extent. Off-site construction should be encouraged. Modularisation with factory testing of whole systems could greatly simplify the expensive and time-consuming work required on site. There are many other examples.

Most major projects have a fair degree of complexity, and this one set a new standard. The complexity itself might have been (more) manageable if there had been more attention paid to the need to address the programme from a holistic (integrated, owning the whole) perspective.

These lessons and themes have of course been intertwined with the human leadership throughout. Each of these themes, in and of themselves, do not tell the full story of what broke down and what worked (and didn't work). We believe the failures before 2018, and the subsequent interventions, came down in large part to the question of how the people involved perceived and viewed these issues, and how they acted and behaved as a result of that perception.

Prior to 2019, there was a shortfall in how people leading the programme looked at what they were confronted with; a lack of a unifying, integrating, coherent vision for where they were heading that catalysed the issues described in the three lessons above to turn into the blockers they became.

The challenges of Crossrail are systemic in nature and not down to any one individual or groups of individuals. The efforts and achievements of leaders and leadership teams throughout the long history of Crossrail have been remarkable. But the environment could have been created to be even more productive, and also could have avoided the loss of confidence and opportunity that affected the programme in its latter years.

