



Department  
for Transport



Infrastructure  
and Projects  
Authority

# Sponsoring a Major Project

## The Crossrail Experience



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# Table of Abbreviations

Abbreviation	Definition
AFCDC	Anticipated Final Crossrail Direct Cost
APM	Association for Project Management
BIM	Building Information Modelling
CEO	Chief Executive Officer
COS	Central Operating Section
CPFR	Crossrail Programme Functional Requirements
CPI	Cost Performance Indicator
CRL	Crossrail Ltd
DfT	Department for Transport
ELC	Elizabeth Line Committee
GLA	Greater London Authority
HMT	HM Treasury
HS2	High Speed 2
IAAP	Integrated Assurance and Approval Plan
IP0, IP1, IP2	Intervention Points 0, 1 and 2
IPA	Infrastructure and Projects Authority
LOD1, LOD2, LOD3	Lines of Defence 1, 2 and 3
LTC	Lower Thames Crossing
MI	Management Information
MPA	Major Projects Association

<b>Abbreviation</b>	<b>Definition</b>
MPLA	Major Projects Leadership Academy
NAO	National Audit Office
NEC	New Engineering Contract
NED	Non-executive director
NR	Network Rail
ONFR	On Network Functional Requirements
ONW	On-Network Works
ORR	Office for Rail and Road
PDA	Project Development Agreement
PFI	Private Finance Initiative
P Rep	Project Representative
P50, P80	The estimate of costs such that there is a 50 or 80 per cent probability of the project being delivered within that cost estimate.
ROSCO	Rolling Stock Leasing Company
RP1, RP2, RP3, RP4	Review Points 1, 2, 3 and 4
SA	Sponsors Agreement
SPI	Schedule Performance Indicator
SRO	Senior Responsible Owner
TfL	Transport for London
TRU	Transpennine Route Upgrade

# Foreword



## Bernadette Kelly, Permanent Secretary, Department for Transport and Andy Lord, Commissioner, Transport for London

Major public transport infrastructure projects underpin long term growth, connect communities, and create opportunities for people in a sustainable, predictable, and meaningful way. The Crossrail project, and now the Elizabeth line, has this at its heart.

Crossrail is one of the most transformational infrastructure projects ever delivered in the UK, adding ten per cent to central London's rail capacity. Creating a vital new transport artery for London and the south-east, connecting east and west through the heart of central London, and bringing 1.5 million people within 45 minutes of the capital.

Beyond this, it is rejuvenating London's town centres from Ealing in the west to Romford in the east and has directly connected the UK's largest airport to the UK's two major financial districts<sup>1</sup>.

Equally important are the wider economic benefits the Elizabeth line is bringing and will bring in future, with an expected £42 billion contribution to the UK economy. Through construction, Crossrail awarded 62 per cent of its contracts to firms outside London, created 55,000 new jobs and 1,000 apprenticeships.

Now that it is complete, Crossrail has rightly attracted praise across the world for its scale and ambition. It has set new standards for accessibility and design, introducing ten brand new stations to the network, and refurbishing over 30 existing stations, all of them with step free access.

The Elizabeth line is already proving incredibly popular; in its first year of operation the new railway welcomed more than 150 million journeys, and every day thousands of people choose the Elizabeth line as their preferred mode of transport. Around 700,000 daily journeys are being made on midweek services, far exceeding the post-pandemic expectations of 500,000 daily users.

It is fitting that the railway named in honour of our longest serving monarch, Queen Elizabeth II, was opened by Her Late Majesty ahead of her Platinum Jubilee celebrations.



However, like all major projects, the road to eventual success has not been an easy one. Despite the many successes since opening and the efforts to get the project back on track after 2018, we must acknowledge and reflect on what caused the delay and increased costs, and why. We must ensure that as an industry we learn from past mistakes to improve the delivery of future major projects and the value for money for taxpayers and farepayers alike.

This report examines the joint sponsorship model, which was established between TfL and the DfT to deliver Crossrail. The delivery model established an arm's length body, Crossrail Ltd, to build the project. As is to be expected, there were benefits to this model, but there were challenges too. This report explores these further and draws out some important lessons for us, DfT and TfL, as joint sponsors, as well as wider industry.

We would like to thank everyone who has contributed their time to this report, and those past and present who have helped deliver the Elizabeth line.

We are committed to embedding the key recommendations from this report in our future programmes of work.

**Bernadette Kelly**  
Permanent Secretary  
Department for Transport

**Andy Lord**  
Commissioner  
Transport for London

# Foreword



## Nick Smallwood, Chief Executive, Infrastructure and Projects Authority

Infrastructure is, and will continue to be, a critical driver of UK economic growth and national renewal at a time when it is really needed. But it is much more than that – it supports the government’s ambitions of reaching net zero, levelling up and encouraging innovation in all parts of the country. That is why we must continuously learn what went well, or not, on our previous projects and programmes. It is no secret that some projects fail and others flourish – but one of the biggest enablers of those that succeed is that they factored in lessons learned from the outset.

This report has nine main lessons learned, and while some may appear obvious in hindsight, every one of these lessons will help sponsors in delivering complex infrastructure projects. The recommendations from Crossrail are practical and clear for all project professionals to embed, and so should be considered in every infrastructure project’s psyche.

### Key challenges

In particular, the report raises two key challenges for government. The first is to continue to professionalise project delivery, and the second is to evolve our methods of project assurance in order to cut through group think. The IPA, with the support of colleagues in major departments, has made large strides in raising the capability and profile of the project delivery profession within government. We have already made a positive impact through building the skills and capability of project leaders across government, but of course there is always more we can do, particularly with regard to effective sponsorship.

### The importance of sponsorship

Sponsorship is vitally important to a project and goes beyond being an administrative or funding function. It is a professional skill that depends on people with directly relevant delivery and operational experience. Most importantly, it requires the ability to ask basic questions, such as “does the project feel right?” or “is it ready for the next phase?” and then act in the right way, landing the key messages with good effect, coping with ambiguity, and managing senior stakeholder expectations in a realistic way.





With this in mind, government now has an opportunity to grow and sustain its sponsor talent pool. Our projects are only as strong as the capability of our people, so providing quality training, support, and mentorship for those in the sponsor community is paramount.

## Getting assurance right

Another key consideration from the legacy of Crossrail is how we evolve the existing assurance regime within government to avoid the perils of group think. This is something that Crossrail could have improved upon, and it is relevant to all assurance teams across government, working across all the lines of defence:

- Review teams must penetrate beyond group think and examine the source data when forming a view of delivery progress. This means making site visits during construction and interviewing suppliers, future operators, regulators and third parties with valid insights. Review teams should meet those at the front line to hear about progress first hand and talk to the people responsible for interfaces.
- Complex projects using delivery agents should consider the merits of appointing an effective, experienced, senior-level Project Representative and then manage that relationship actively, bringing in fresh people at intervals to guard against group think.
- Short sharp reviews of the largest and most complex projects run the risk of merely scratching the surface. In these instances, consideration should be given to conducting longer, deeper dive reviews less often. Doing so may reduce the total assurance burden and increase the level of insight.

I am pleased to see the continued use of the 24 lessons identified in [‘Lessons from transport for the sponsorship of major projects’](#),<sup>2</sup> which DfT and IPA published in 2019 – this, alongside the nine main lessons identified here, will no doubt increase the deliverability and success of major projects in the years to come. Without this essential knowledge of the past, we cannot create a brighter future, so I encourage all project professionals to leverage these lessons to help us meet our shared ambition of building world-class infrastructure and vital public services.

**Nick Smallwood**  
Chief Executive,  
Infrastructure and  
Projects Authority

# The 9 Lessons Learned



The sponsor should regularly check and ensure that a project delivery vehicle's board is effective, is obtaining insightful programme integration assurance and has realistic management information and performance metrics.



The sponsor should ensure that the Chair's and NED's experience and organisational capabilities match the evolving nature of the work, supplementing and replacing capabilities in anticipation of the next phase.



The sponsor should design the external scrutiny and assurance to avoid group think, specifically considering both integration and entry into service requirements as well as other project risks.



Ensure the sponsor's own role is clear, its people have relevant practical delivery experience and authority, and there are pre-planned capability review points at intervals aligned to the evolving needs of the project.



At the project's outset the sponsor should configure the governance, levers, and incentives to encourage solution integration and entry into service.



Having created a delivery model for the project at the outset, the sponsor should formally review and adapt it at set and agreed intervals.



The sponsor should own clear outcome-based requirements, staying sighted and accountable at pre-agreed decision points as the project delivery organisation translates them into detailed functional requirements.



Even in a highly devolved delivery model, the sponsor should maintain sight of and manage, or at least formally agree to, material scope, schedule and cost trade-offs arising through design and construction development throughout the project's life, informed by the benefits realisation impact.



The sponsor's requirements should stipulate integrated digital asset management data in design and construction.



# Executive summary

**This report shares the Lessons Learned about the way the Department for Transport (DfT) and Transport for London (TfL) established and managed the joint sponsorship and governance arrangements on the Crossrail project. The Joint Sponsors comprised the senior accountable officers of the two primary sponsoring organisations with a supporting staff team usually totalling between 10 and 15 people.**



This review also compares Crossrail's joint sponsorship arrangements with other major projects such as High Speed 2 (HS2)<sup>3</sup>, the Transpennine Route Upgrade (TRU) and the Lower Thames Crossing (LTC).

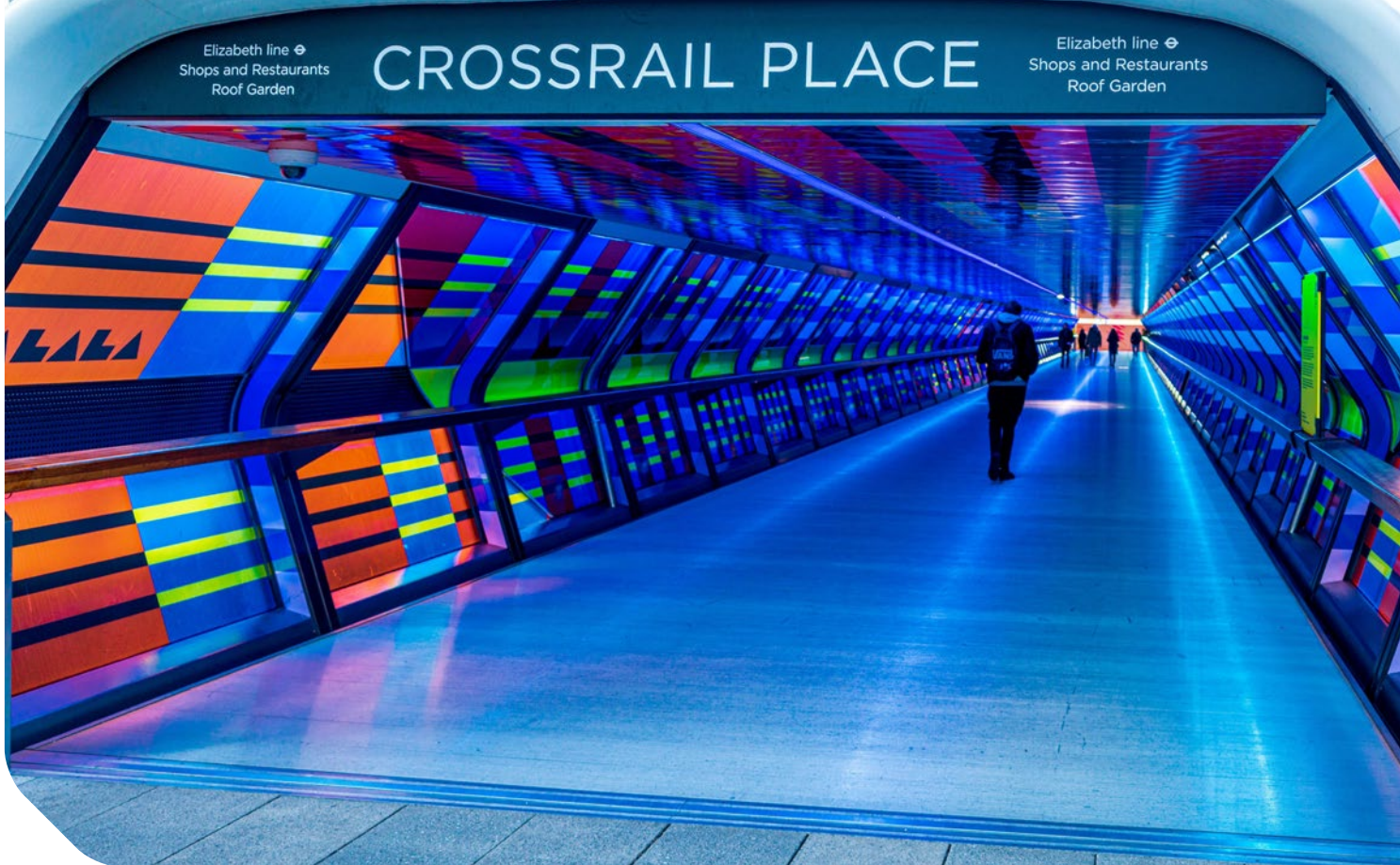
The government provided loans and grants totalling c. £9 billion in support of Crossrail's delivery. On their repayment, 70% of Crossrail's funding will have come from London (30% fares and 40% businesses) and 30% from central government.

Today's Crossrail originated in the early 2000s, a time of change in the construction and rail sectors. Network Rail (NR) was being established as an arm's length public sector regulated organisation. Likewise, the newly formed TfL was becoming a statutory body with responsibilities for safe, efficient, integrated, and economic transport services. Project Management was a maturing profession, and the New Engineering Contract (NEC3 then 4)

was not yet mainstream. The Private Finance Initiative (PFI) was still a government endorsed funding, delivery, and operational model. There was optimism after winning the Olympics, but Crossrail's procurements came after the global financial crash in 2008 which many interviewees felt influenced both the buyers' and the bidders' strategies.

DfT and TfL signed the Sponsors Agreement (SA)<sup>4</sup> in 2008, a binding agreement between the two main parties setting out the delivery arrangements for Crossrail. The principles and requirements of the SA in turn matched the Project Development Agreement (PDA)<sup>5</sup> between the Joint Sponsors and Crossrail Ltd (CRL), which was an arm's length body specifically set up to deliver the Crossrail project.

Procurement was well underway by 2010. The tunnelling phase was a remarkable engineering feat, creating a high-quality asset that will last for generations. In 2018 CRL began to report significant cost and schedule pressures; the Joint Sponsor then intervened to change key CRL staff, strengthen the CRL Board and work with CRL to rebaseline the project. By 2020 that exercise was largely complete and the view of the Joint Sponsors was that TfL would then, as always intended, exercise stronger accountability and responsibility for pulling the railway into live operations. That phase involved a determined effort to complete the testing and commissioning while coping with the significant impacts of the COVID-19 pandemic.



## Positive features of the joint sponsorship governance arrangement

Set against that changing and challenging context, many positive features of the Crossrail sponsorship approach stand out, the most significant being:

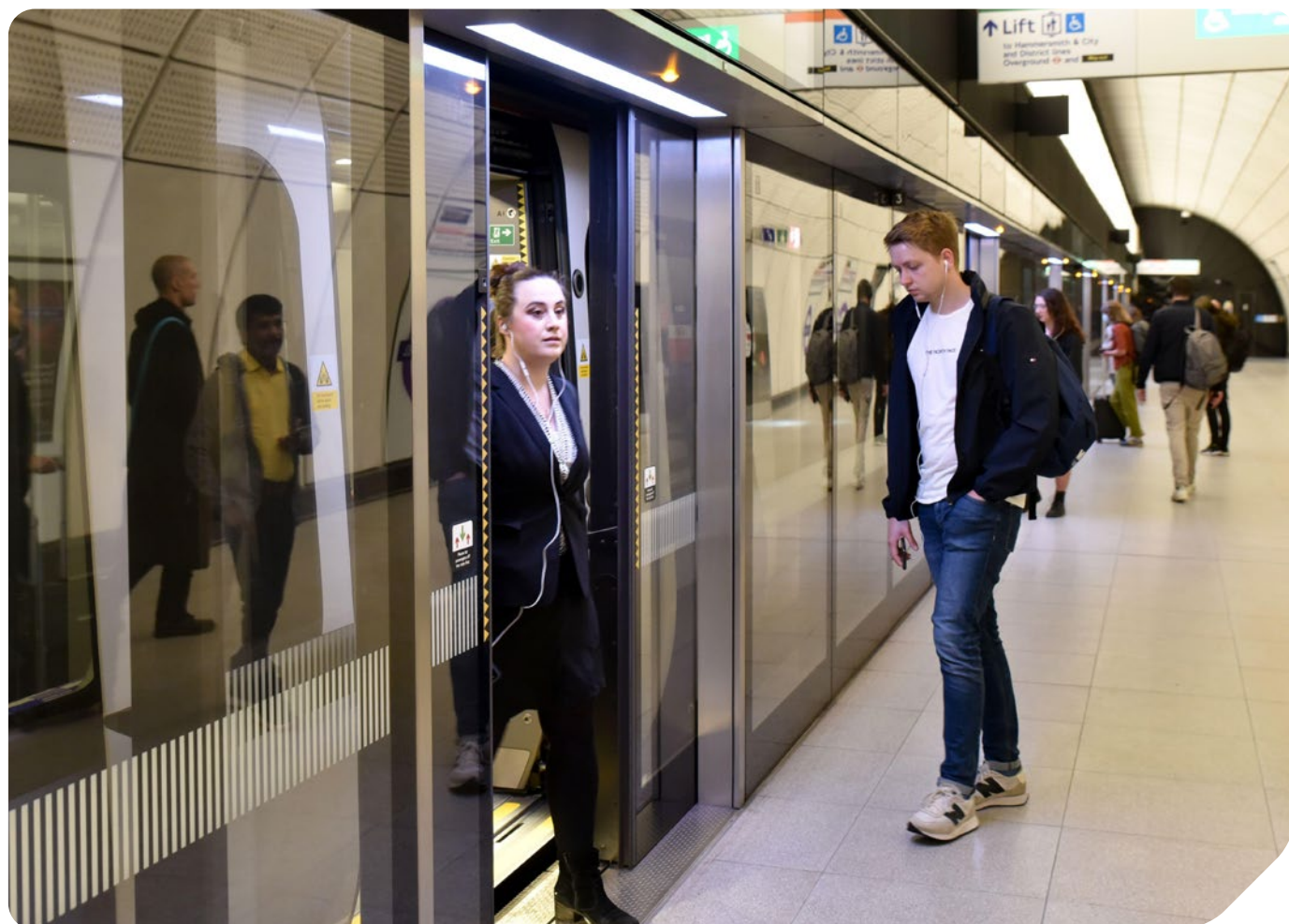
- **Establishing an arm's length project delivery vehicle enabled a strong start.** Acting individually, the Joint Sponsors would have lacked the necessary delivery capabilities, powers, and freedoms of action. A highly empowered delivery vehicle reporting to the Joint Sponsors led to a decisive start.
- **The SA was a shield against scope changes.** The Joint Sponsors had limited delegated authorities, necessitating consultations within DfT and TfL when changes were mooted, whether by CRL or either of the Joint Sponsors. Governance processes were effective with thorough checks and balances and resulted in few scope changes during the life of the SA. This reduced the risk of disruption, cost increases and delays from sponsor-driven mid-delivery scope changes and the onus was mainly on CRL to seek out and implement delivery efficiencies and maximise opportunities.
- **The Sponsors Requirements were outcome-based.** They were written in plain English, which was excellent practice, standing the test of time.
- **Early operator involvement was essential.** TfL would become responsible for operation of Crossrail services and its positioning as a Joint Sponsor ensured skin in the game from the outset. That model, including TfL's engagement as shadow operator and as long-term operator, was highly beneficial.
- **The joint sponsorship model proved effective when in crisis mode.** It coped collaboratively and purposefully after CRL's 2018 declarations of delays and cost pressures, for example in moving the CRL Board's composition away from civil engineering towards systems integration and operational railway commissioning and in resolving the additional funding requirements.

## The main challenges facing the Joint Sponsors

The joint sponsor arrangement faced some significant challenges, though, many only becoming clearer in hindsight. Most notably:

- **The Joint Sponsor team needed stronger capabilities.** The Joint Sponsor team was resourced to be small, light touch and relatively junior. It did not have the capabilities, experience, or contractual levers to act on important, and growing, concerns about CRL's delivery.
- **CRL's optimistic solutions-orientated culture masked risks.** The "can do" culture injected pace and incentivised progress but inhibited its junior staff and contractors from surfacing problems.
- **The CRL Board had a short-term focus.** Tunnelling under London was a major technical challenge successfully overcome, although there were some delays which reduced later room for manoeuvre, but the CRL Board or Executives did not focus soon enough on the scale of the systems integration effort required to bring the railway into service. Risks were often managed on an individual basis, rather than recognising their inter-relationships with the rest of the project.
- **The Management Information (MI) gave a misleading picture.** The total scope of the commissioning effort was not known or did not become clear for many years, so the MI and initially construction-centric performance indicators tended to overstate progress in the years leading to 2018.
- **The governance arrangements lacked formal review points.** The delivery model was complex, involving NR's line, station, and signalling enhancements on the Great Western and Anglia rail networks, CRL and its contractors delivering the Central Operating Section (COS), TfL's rolling stock delivery management, and system integration across the combined whole. There were no planned review points of the governance arrangements during the life of the project and any evolutions took place through discussion and consent when the needs arose. Pre-planned review points would probably have helped with the preparation and delivery of those transitions.
- **The Joint Sponsors lacked controls over the emerging design.** Under the devolved delivery model, CRL interpreted the Sponsors Requirements, translating them into Crossrail Programme Functional Requirements (CPFRs) and On Network Functional Requirements (ONFR). The Joint Sponsors had no approval role in the evolving solution, as per their intended arm's length positioning in the governance ecosystem; doing so would have contradicted the outcome-based delivery model. While this brought clarity and stability, interviewees suggested a need for standard-setting in the Sponsors Requirements or an enhanced Joint Sponsor remit.
- **External scrutiny did not surface the scale or impact of the risks.**
  - The National Audit Office (NAO) reviewed Crossrail in 2014<sup>6</sup>, noting CRL's apparently good progress. The Infrastructure and Projects Authority (IPA) conducted Project Assurance Reviews<sup>7</sup> in 2015 and 2017, both with Amber/Green gradings. CRL commissioned its own external reviews of the schedule in 2017 and 2018. None foresaw the scale of the imminent schedule and cost pressures relating to systems integration, commissioning, trial running and regulatory approval.
  - The same NAO report also noted the Project Representative's (P Rep's) strong internal challenge to CRL which contrasts with the views given in hindsight by interviewees in this review that the P Rep didn't escalate the systems integration and commissioning risks forcefully enough, particularly in the years running up to 2018. Intentionally the P Rep did not have powers to intervene, merely to warn. It was for the Joint Sponsors to intervene but they lacked the experience and contractual authority.

- **The Joint Sponsors had few levers in the governance framework during delivery.**
  - The Joint Sponsors had rights to approve CRL's recommended senior appointments and could each nominate at least one non-executive director (NED) to the CRL Board. The Joint Sponsors usually endorsed CRL's recommendations to re-appoint incumbents when their contracts concluded.
  - The Project Development Agreement (PDA) contained trigger events that gave either TfL or the Secretary of State (depending on the circumstances) step-in rights, in the event of costs exceeding the approved forecast, delays of more than six months or poor performance. In practice, these did not give early enough warning or enable timely intervention.
- Three contractual Intervention Points (IPs) linked to the total cost forecast did not give the intended early warning because the consumption of contingency funds masked the cost pressure trends. The first IP was not triggered until 2016, by which time there were few corrective options open to the Joint Sponsors.
- **Integrated data capture was a challenge during asset creation.** Building Information Modelling (BIM), a relatively new way of collecting and integrating asset data when the Sponsors Requirements were written, proved difficult to implement as suppliers held their data on local systems.



## Conclusions

Six “Lines of Defence” (LODs), shown in Figure 1, have particular relevance when designing, establishing, and managing an arm’s length capital project delivery company. All six LODs need careful consideration, as an integrated whole, when deciding a project’s delivery approach, sponsorship structure and governance.

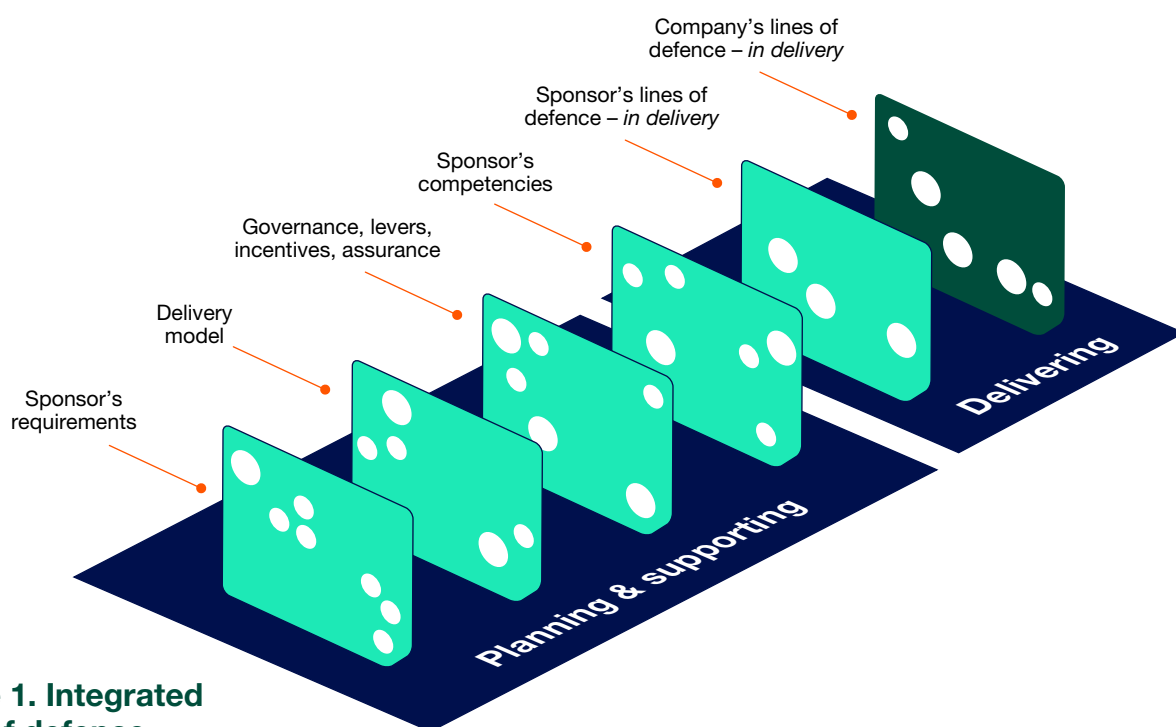
In the early stages of project inception, the focus flows from left to right in Figure 1, i.e. first set the requirements and then decide on the delivery model, governance, and incentives in relation to the available or bought-in competencies within the sponsor organisation. Having done that, the attention turns towards creating strong lines of defence for the delivery phase, in which both the sponsor and delivery organisation have important roles to play.

During delivery, the first line of defence is the arm’s length delivery body itself. The performance of the board, its programme integration and its project delivery competency must be robust and effective.

As a second line of defence during delivery, the sponsor checks that the company is delivering the required outcomes and intervenes if not. The other four lines of defence apply throughout. For example, the sponsor retains an inquisitive stance, checking that the governance is working, that the delivery model remains effective, that changes are managed in a structured way and that the sponsor’s own competencies evolve in line with the project’s needs.

Where do sponsors come from within the Civil Service? Positioned right at the top of the governance ecosystem, a sponsor should have sector-specific credibility and a blend of practical senior project delivery and Civil Service leadership experience. That combination of skills and experience is usually hard to come by.

The government’s Major Projects Leadership Academy (MPLA) programme is helping to raise project delivery capabilities across the Civil Service. Developing a sponsor cadre for a selection of MPLA graduates could be an effective response and would require design, support, and funding.



**Figure 1. Integrated lines of defence**



Deploying a P Rep to support a sponsor who lacks the full set of capabilities may bridge the gap to an extent, but the sponsor still needs to interpret what is being said and having done so, have the confidence to act on instinct, judgement, and experience, often relying on soft clues and ambiguous indicators. More thought about the career paths for government project sponsors would be a helpful next step.

What is the optimal size for a sponsor unit? HS2's was 160-strong (before the announcement cancelling Phase 2), exerting a detailed scrutiny process that carries an administrative cost and reporting burden, with 65 members undertaking direct sponsorship similar to Crossrail's Joint Sponsor team. At this relatively early stage on TRU, the sponsor unit is approaching 50-strong. Crossrail's sponsor unit typically comprised around 10–15 people and the sponsor unit for LTC has fewer than five people in it, albeit highly experienced. There is no obvious link between project value and the size of the sponsor unit, and the dominant determining factor may turn out to be the scale of the retained powers.

The Major Projects Association (MPA) has recently dedicated a conference to the role of the sponsor<sup>8</sup> and further consideration feels like a useful next step.

Interviewees consistently noted that the [2019 DfT / IPA 24 Lessons Learned<sup>2</sup>](#) paper remains relevant and useful. Other major projects and programmes such as HS2, TRU and LTC have used to good effect the 24 Lessons Learned principles in their planning and risk assessment processes.



# 1





# Introduction

**This report, commissioned by DfT and the IPA, and endorsed by TfL, shares the lessons learned about Crossrail's sponsorship and governance arrangements.**



**This introductory section provides:**

- 1.1 Historical and physical context
- 1.2 Summary of key roles in this report
- 1.3 An overview of the approach taken in this review

# 1.1 Historical and physical context

**Crossrail’s complexity, with its joint sponsorship model and its multiple signalling and operational service environments, sets it apart from other projects. Those circumstances may never recur in quite the same form, but this report’s lessons are pertinent to other government infrastructure investments.**

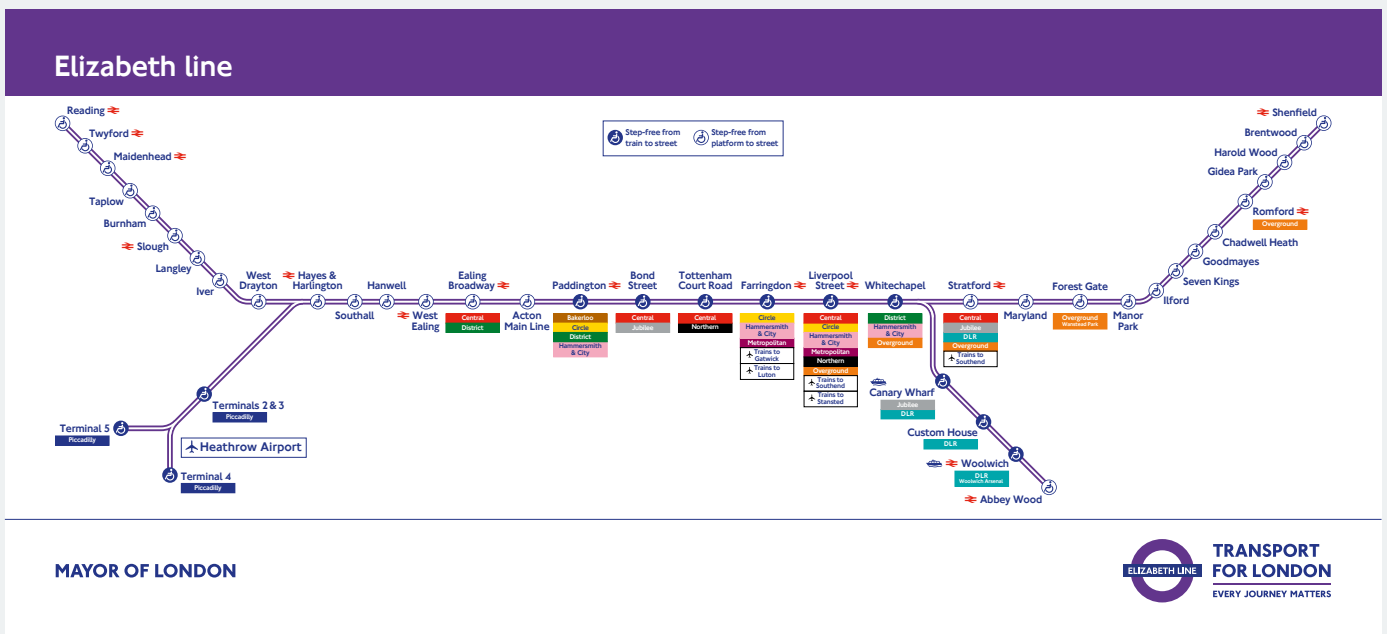


The illustration below<sup>9</sup> shows the extent of the Elizabeth line. CRL, working with important delivery partners such as NR and Heathrow Airport Ltd, delivered the integrated railway which runs for over 100km through central London from Shenfield and Abbey Wood in the east, to Reading and Heathrow in the west; it comprises 41 stations, of which 10 are new.

The UK government had wanted to deliver a Crossrail-style solution for more than half a century; there was an attempt to establish a project in the mid-1990s. The current version of Crossrail spanned two decades, from inception

in the early 2000s through to the start of the Elizabeth line’s end-state peak timetable in May 2023. The project evolved over that time, progressing from its early conceptual creation, through the business case production, funding discussions, parliamentary process and thereafter into delivery; comprising tunnelling, rolling stock procurement, routeway fit out, testing, trial running, regulatory assurance, and trial operations. TfL and DfT developed the Crossrail project, later known operationally as the Elizabeth line, starting in 2001. The Crossrail Bill came before Parliament in 2005, gaining Royal Assent in 2008.

It is easy to criticise in hindsight a project that spanned two decades from inception to completion, given developments in project delivery tools, data-driven information management and changes to the economic landscape. Decisions in the early 2000s can seem strange and out of place in today’s context. The purpose of this report is not to criticise what might now seem to be obvious shortfalls, but to identify useful lessons learned with a particular emphasis on illuminating the role of the sponsor.



## 1.2 Summary of key roles in this report

Thousands of people contributed to Crossrail’s delivery involving the main or Tier 1 contractors, the Tier 2 sub-contractors, the designers, and other advisers. This report concentrates on the sponsorship and governance arrangements that prevailed at the strategic level, the main parties being:

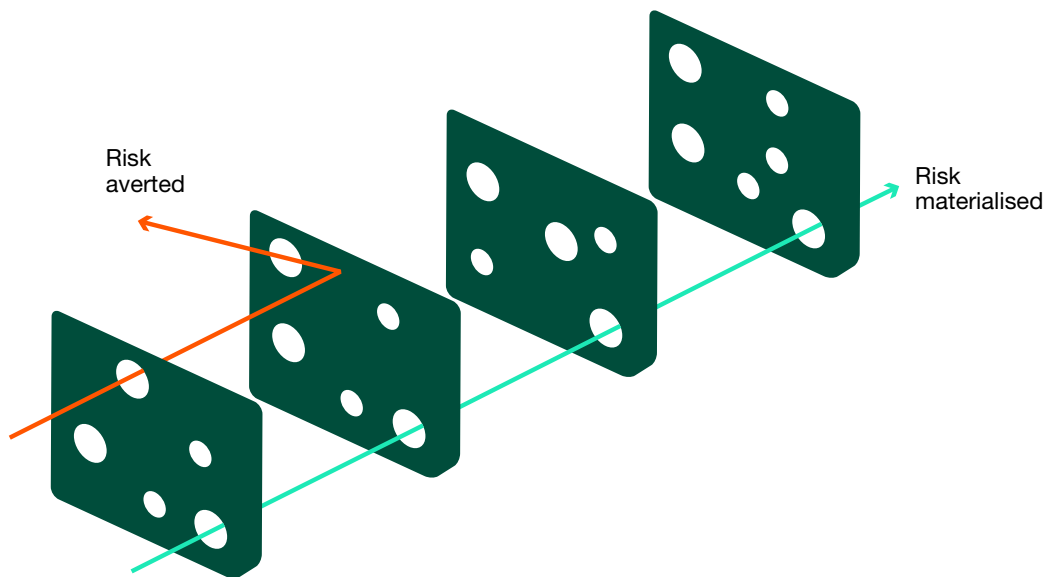
- 
- CRL – TfL established this new subsidiary company to deliver Crossrail
  - TfL and DfT – Crossrail’s Joint Sponsors
  - HM Treasury (HMT) – with an interest in the benefits; also, one of the funding organisations
  - The Greater London Authority (GLA) – with a strong interest in communities and businesses along the route and one of the funding organisations
  - NR responsible for the On-Network Works (ONW) on the east and west sections on either side of the COS
  - The P Rep, an organisation providing independent commentary and assurance to DfT and TfL
  - Bombardier / Alstom<sup>10</sup> – provider of the rolling stock
  - NAO and the IPA – sources of external assurance, advice, and commentary
  - The Office of Rail and Road (ORR) – the rail regulator



## 1.3 An overview of the approach taken in this review

**Matthew Symes was appointed to lead the independent review and write the report. A Chartered Civil Engineer, with a client-side career in major infrastructure and business transformation programmes, Matthew has led 100+ reviews of projects and programmes, often for the UK government. Rob Brighthouse, a non-executive director for NR and acting in a personal capacity in this instance, provided support and constructive challenge throughout the review process.**

This report collates and distils an amalgam of wisdom earned at different times by different people who shaped, led, and delivered Crossrail; nearly 100 interviewees and 30+ workshop attendees have helped build up a coherent retrospective understanding. It is never possible in a review of this nature to establish a complete and unified version of events because people’s recollections differ, and their perspectives or organisational positioning affect their conclusions about the way events turned out. That said, a clear, consistent set of themes emerged from the people interviewed, sufficient to have confidence in the nine recommendations listed on p. 10 and discussed later in the report. Thanks go to all for their thoughtful inputs supporting this work.



**Figure 2. The “Swiss Cheese” model**

The “Swiss Cheese” model<sup>11</sup> is a helpful way of thinking about, ordering and presenting the lessons learned from Crossrail. Figure 2 illustrates how a risk might pass through one line of defence before interception by another. If a risk penetrates all the lines of defence its impact will materialise and affect the project, possibly proving critical depending on its scale.

The structure of this report follows the six lines of defence in Figure 3. It considers the company’s lines of defence first, before then addressing those of the Joint Sponsors. The remainder of this report has two main sections, as follows:

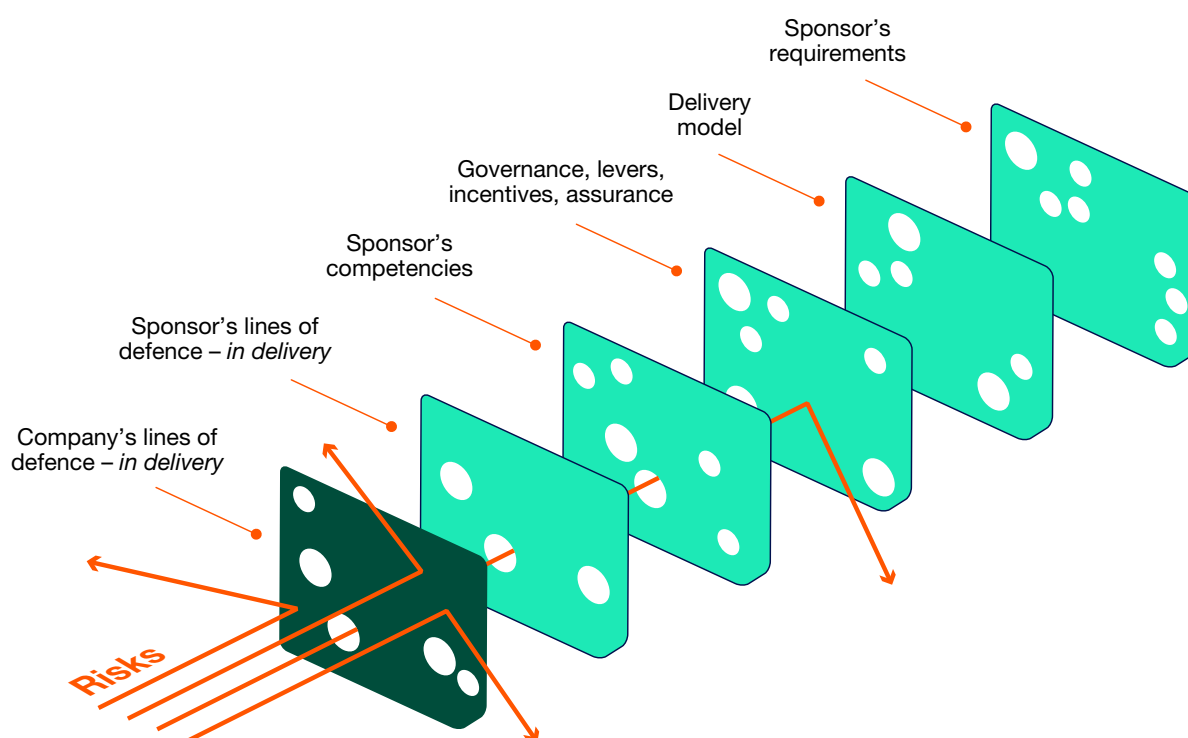
## Section 2 – the Company’s Lines of Defence

- The CRL Board
- CRL’s programme integration capability
- CRL’s project delivery capability

## Section 3 – the Joint Sponsors’ Lines of Defence

- In the delivery phase
- Competencies
- Governance, levers, incentives, and assurance
- The delivery model
- The Sponsors Requirements

Figure 3 presents the structure of the report in a pictorial format.



**Figure 3. In delivery the company’s lines of defence come first, with the sponsor’s lines of defence providing additional mitigation**

The report addresses the Company's lines of defence first, before turning to the Joint Sponsors' five lines of defence. The key question that this report considers is how well did the sponsorship model cope when the arm's length delivery vehicle's lines of defence had weaknesses?

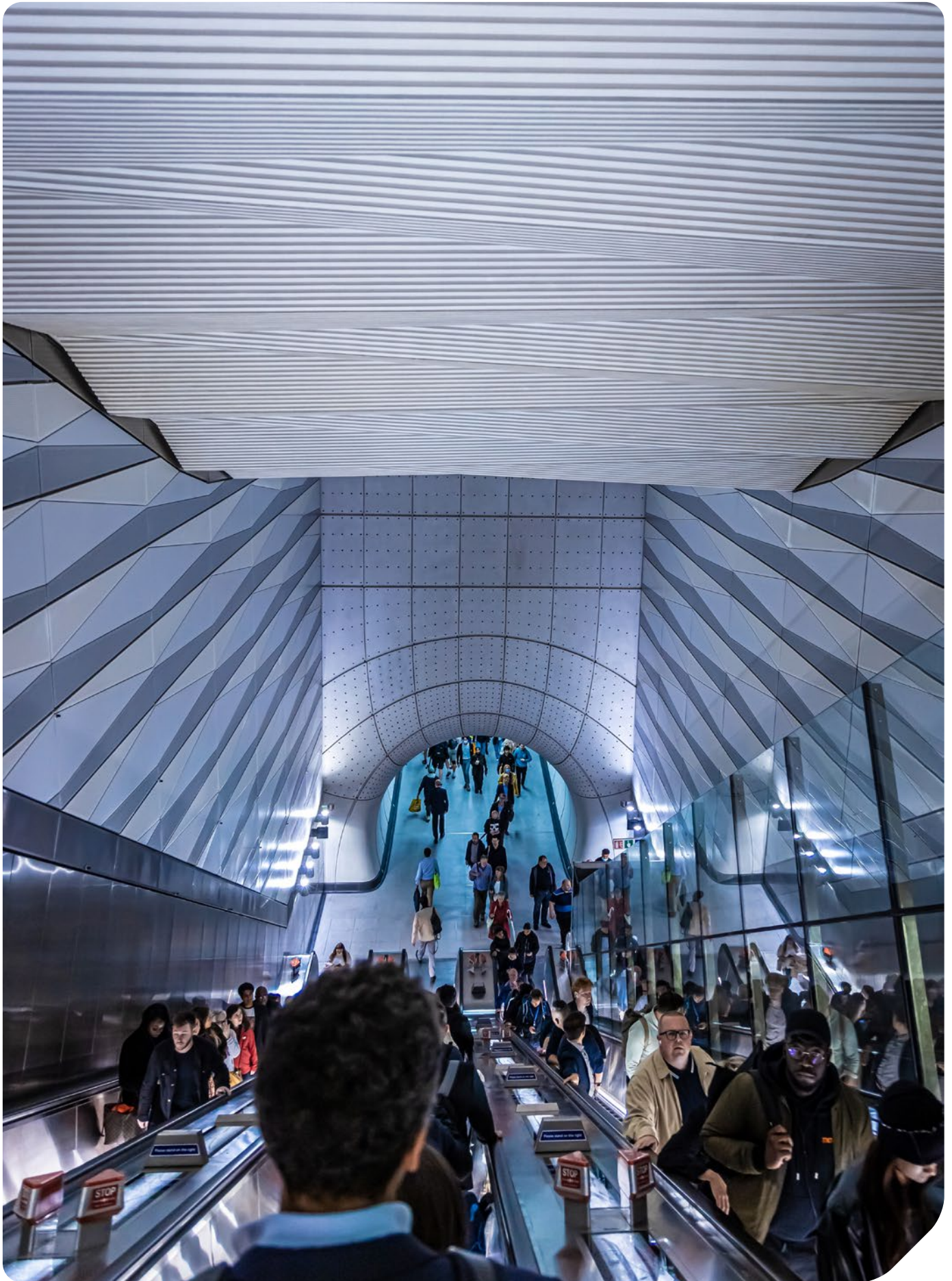
Throughout this report text boxes contain direct quotes from some of the interviewees, maintaining anonymity. These reflect the general themes from the interviews and illuminate points nearby in the surrounding text.

The report has two further Annexes, comprising:

1. Methodology and a list of contributors
2. An assessment of the impact of the ['Lessons from transport for the sponsorship of major projects'](#)<sup>2</sup> paper







2



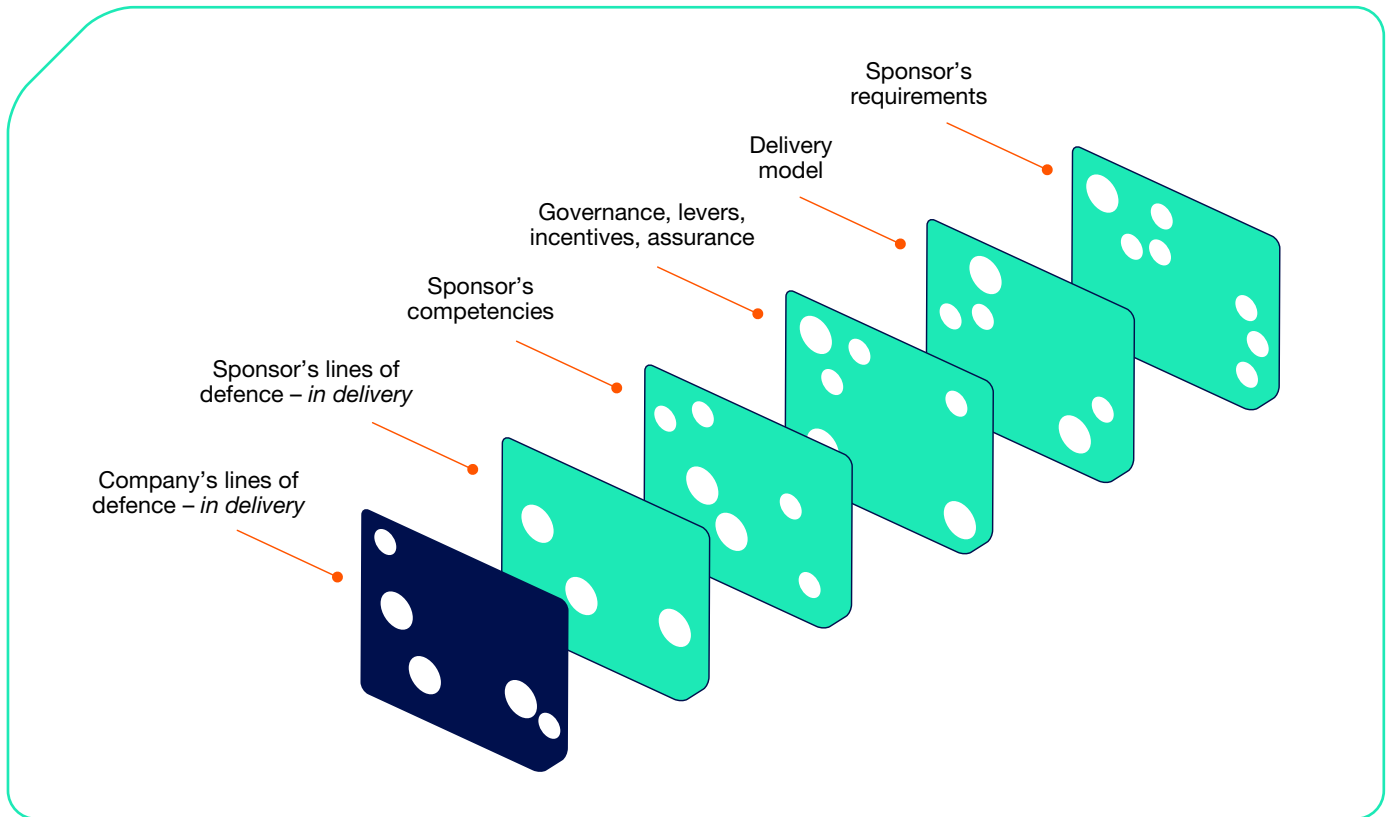


# Crossrail Ltd's lines of defence in delivery

## **This section has the following structure:**

- 2.1 The Company's 3 Lines of Defence
- 2.2 LOD3(C) The Crossrail Ltd Board
- 2.3 LOD2(C) Programme integration
- 2.4 LOD1(C) Project management

## 2.1 The Company's 3 Lines of Defence



The diagram above shows this section's positioning in relation to the others that follow. It examines the challenges within CRL's own lines of defence.

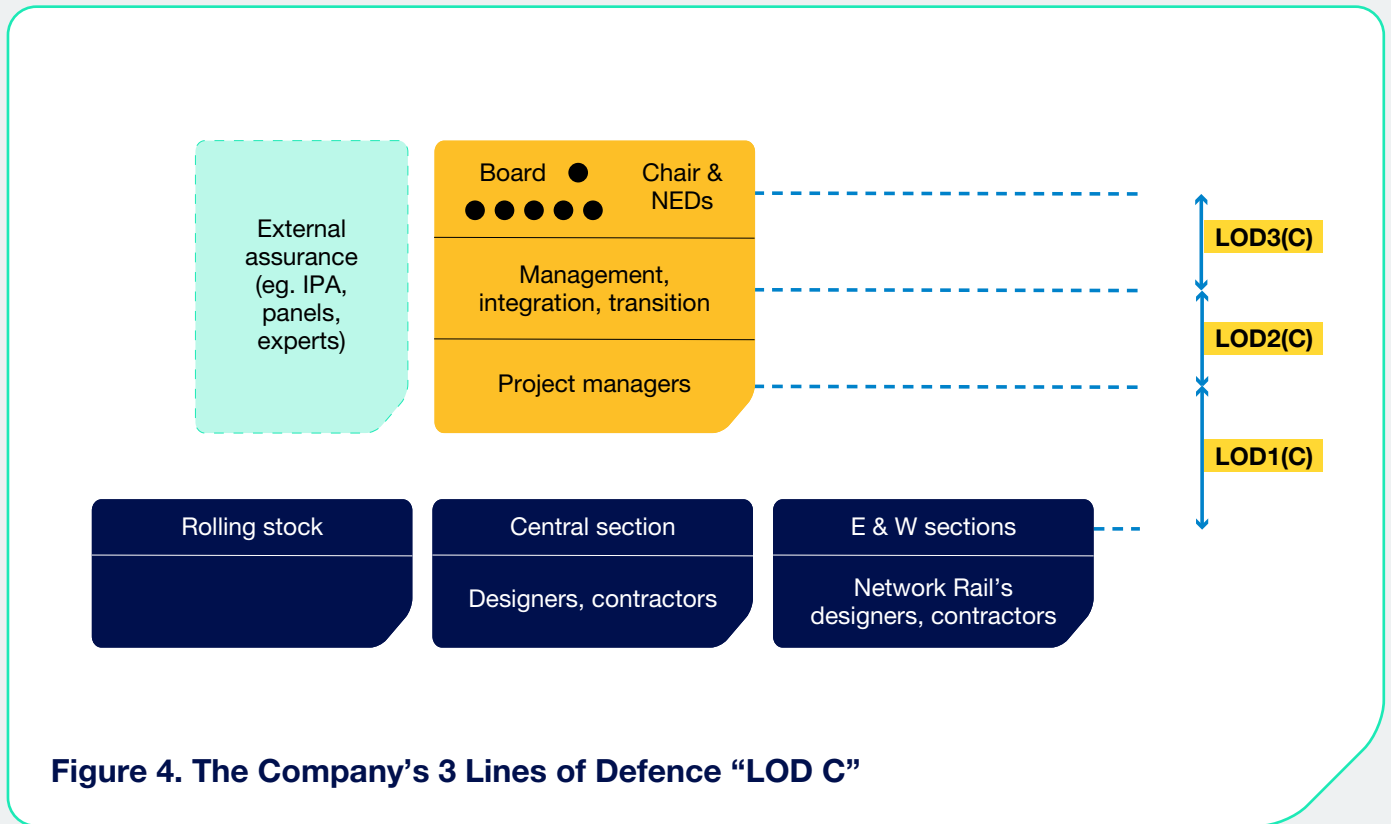


Most delivery companies or Special Purpose Vehicles, including CRL, rely on three lines of defence:

- LOD3 – The board, with its oversight of the management and the running of the company.
- LOD2 – The management, with its programme and systems integration role and its oversight of the delivery projects.
- LOD1 – The delivery project managers, with their oversight of the contractors and designers.

In addition to these lines of defence, a company usually obtains additional challenge and validation from external assurance and from expert panels.

Figure 4 shows CRL's three lines of defence.



## 2.2 LOD3(C) – The Crossrail Ltd Board

The Joint Sponsors established the CRL Board properly, comprising a broad relevant mix of skills including company management, finance, commercial, construction delivery and technical. It lacked, however, people with rail programme delivery skills; when the project mobilised the civil engineering workstreams were the main priority.



Pre-2018 CRL's Board did not have sufficient traction, or a voice, and did not exert effective challenge, particularly regarding programme or systems integration. The culture in the company was one of "can-do positivity". That had the desired effect of galvanizing people, but that focus on success had an unintended consequence of suppressing risk and issue escalation, particularly by junior CRL staff and suppliers. In many respects the CRL Board did not challenge the Executive effectively.

It is of relevance to note that, from its inception, CRL lacked independent assessments (e.g. 360 degree) of the board's performance.

"We had high hopes and really thought we would do it – in hindsight we should have paid more attention to 'psychological safety'."<sup>12</sup>

[pre-2018 comment]

After 2018 new appointments at the board and management levels brought in skills and experience relating to systems integration, testing, and commissioning. The Joint Sponsor sought recovery plans, partly to focus on the work required to complete the project but also to refresh the funding envelope.

From 2020 onwards the board became subsumed into TfL's governance arrangements following establishment of the Elizabeth Line Committee (ELC).



## 2.3 LOD2(C) – Programme integration

CRL correctly recognised from the outset that programme and system integration were key risks. However, CRL significantly underestimated the effort to achieve that and subsequently go through the testing, commissioning, and regulatory assurance processes. CRL did not foresee the scale of the necessary effort. The LOD2 assurance didn't expose the extent of the challenges or risks that lay ahead either, especially in the years leading up to 2018.



After 2018 the Joint Sponsors bolstered the CRL Board and strengthened the technical and programme assurance, but it would by then take the best part of two years for a stable integrated schedule to emerge.

From 2020 onwards, with TfL strongly pulling the railway into live operations, integration became a major focus. Almost irrespective of contractual boundaries, TfL, CRL, NR and key suppliers worked collaboratively to resolve issues and jointly plan the trial running and commissioning. The management effort in that phase was intense, with TfL's Commissioner running daily meetings with key participants to solve live issues.

“CRL didn't get the balance right between engineering construction and technical commissioning and the Sponsor Board shouldn't have allowed that to continue.”







## 2.4 LOD1(C) – Project management

Before 2018 the MI presented a misleading picture. The CPIs and SPIs (Cost and Schedule Performance Indicators) reflected the known scope and progress of the physical tunnelling and other civils works reasonably well. The full scope of the systems works and the indicators for systems integration, however, were harder to define. That gap in the scope definition meant that the reporting tended to be both construction-centric and cost-centric, creating a false sense of total progress.



“The final 5% of the project’s effort requires 20% of the time, as a rule of thumb.”

Before 2018 the P50 costs were the main focus of the cost reports. This also proved to be unrealistic, given the relatively immature systems integration, commissioning detail and risk maturity at that time.

“The measures which worked so well in the early years were not sufficient to relate progress to reality in the later years...”

After 2018 the Joint Sponsor called for reporting at the P80 level too, which gave a better indication of the level of risk facing the project. This is consistent with the IPA’s recommendation to report ranges for expected project completion dates and costs.

The responsibility for maintaining the company’s lines of defence lay with CRL. Notwithstanding that, in response to the revelations about cost over-runs and schedule delays that CRL began to report openly in 2018, the Joint Sponsor asked the IPA to test the effectiveness of CRL’s lines of defence in 2019 and again in 2020. Those reviews provided useful independent recommendations for bolstering the company’s three lines of defence.

Consideration of all the points made in this section leads to the first main lesson learned, as follows:



### Lesson Learned



The sponsor should regularly check and ensure that a project delivery vehicle’s board is effective, is obtaining insightful programme integration assurance and has realistic management information and performance metrics.

# 3



# The Joint Sponsors' lines of defence

## **This section has the following structure:**

- 3.1 Sponsor definitions
- 3.2 The Joint Sponsors' lines of defence during Crossrail's delivery
- 3.3 Joint Sponsors' competencies
- 3.4 Governance and levers, incentives, assurance
- 3.5 Sponsors' integrated delivery model
- 3.6 Sponsor Requirements
- 3.7 Sponsor arrangements on other major projects

## 3.1 Sponsor definitions

**It is worth recalling the guidance offered by the IPA and the Association for Project Management (APM) about the role of the sponsor in project and programme delivery.**



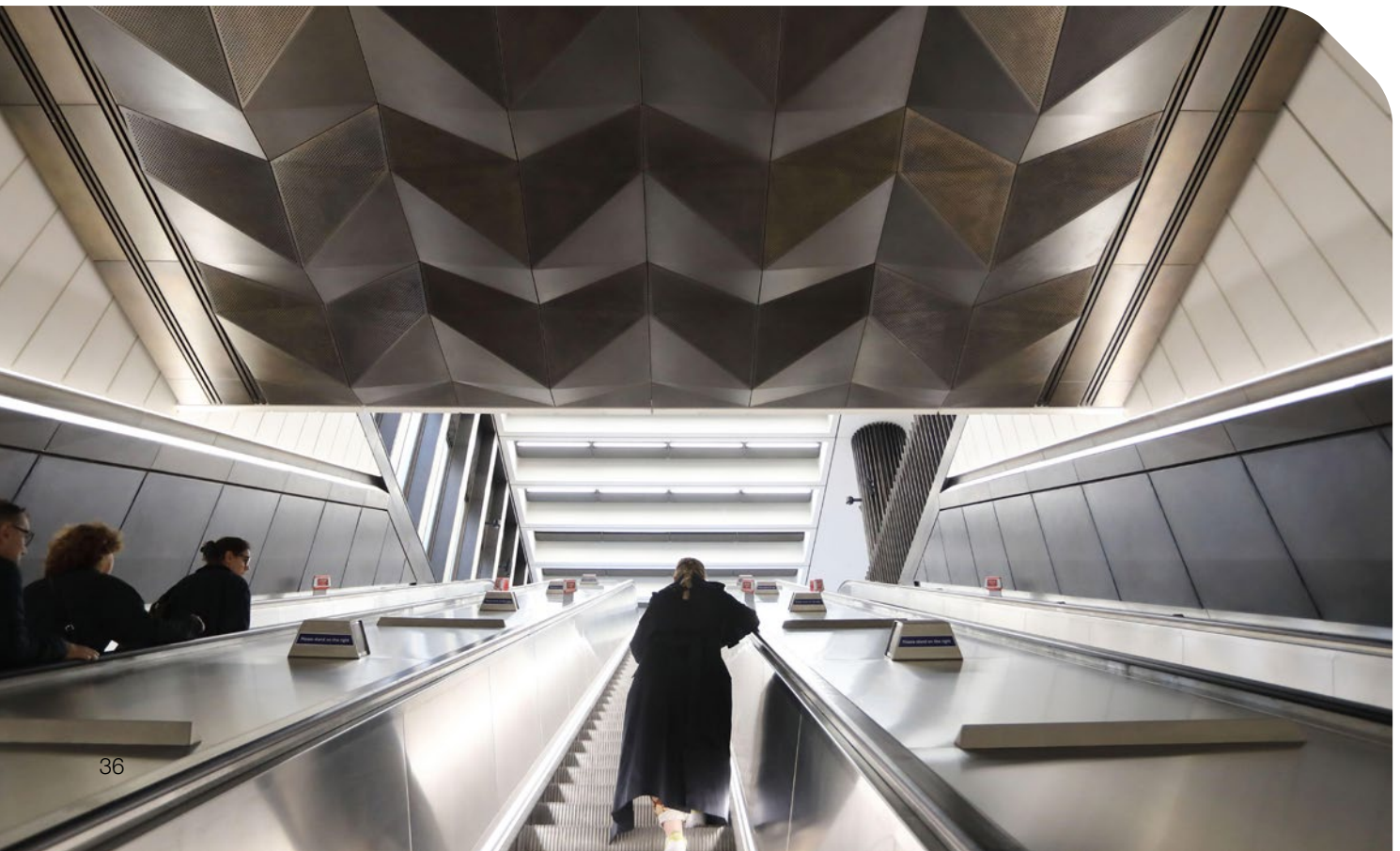
The IPA's Project Routemap<sup>13</sup> indicates that the sponsor:

- Is responsible for championing the project and specifies what it needs to achieve.
- Owns the business case and secures the funding for the project.
- Ensures that the project remains strategically aligned, viable and delivers its whole life value.
- Ensures that benefits are on track to be realised.

The APM offers a useful definition too<sup>14</sup>:

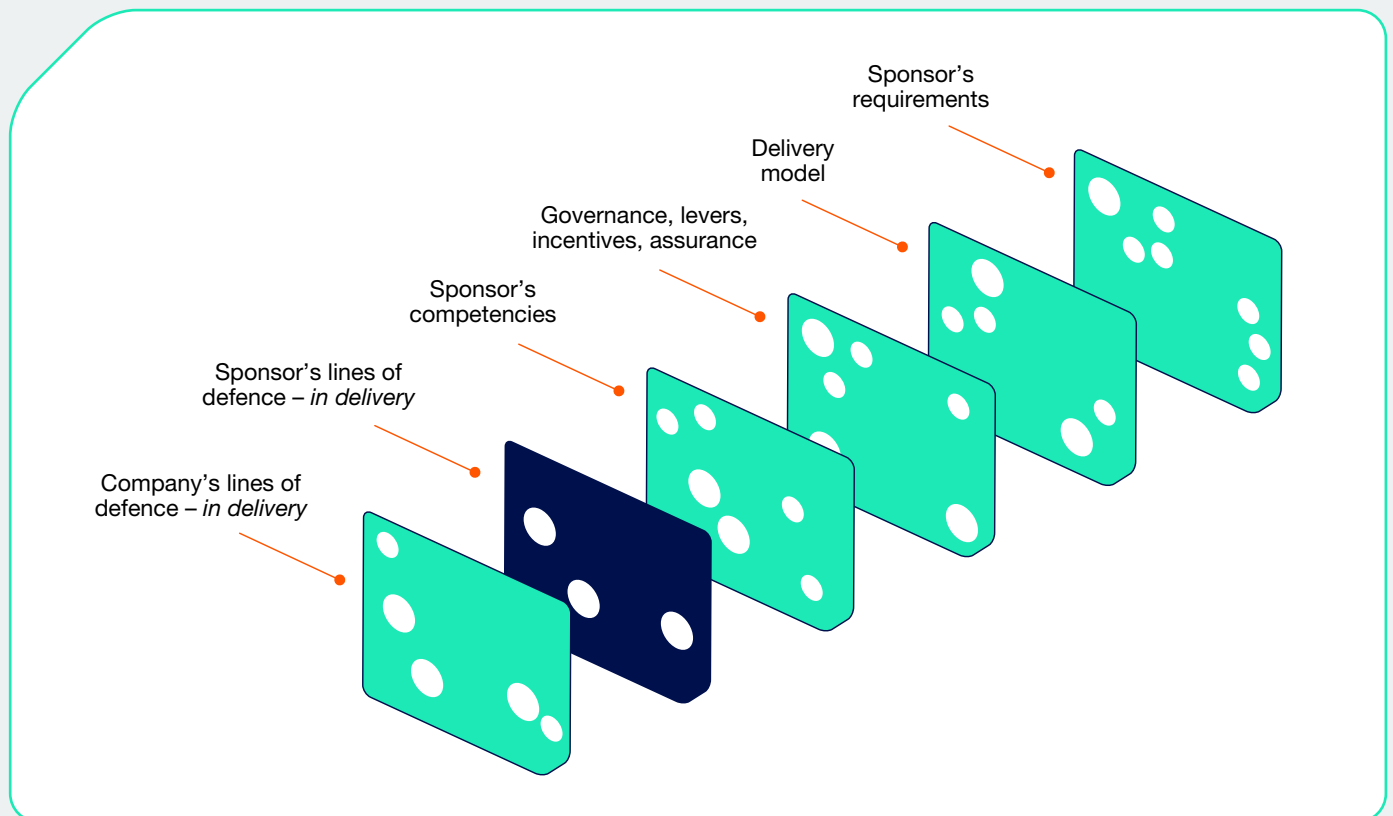
- The sponsor has a critical role as part of the governance board of any project, programme or portfolio. The sponsor is accountable for ensuring that the work is governed effectively and delivers the objectives that meet identified needs.

On the Crossrail project, the SA, which was several hundred pages long, defined the role of the sponsorship arrangement, the thrust of which was entirely consistent with the principles offered by the IPA and APM. This report returns to that topic in the sections below.



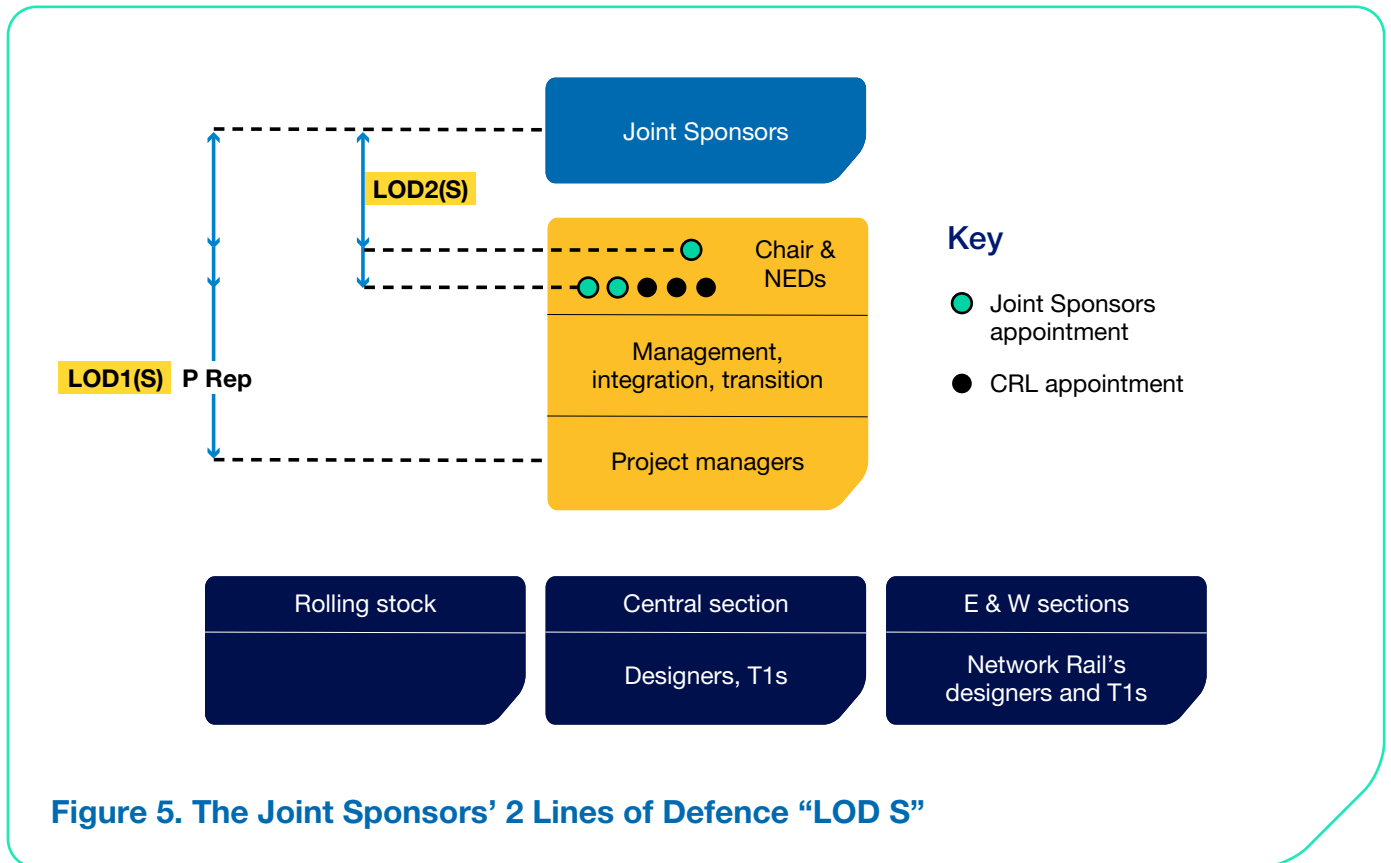
## 3.2 The Sponsors' lines of defence during Crossrail's delivery

Using the navigation pane below for reference and orientation, this section now examines the main lines of defence available to the Joint Sponsors during Crossrail's delivery.



As well as relying on the effectiveness of CRL's own lines of defence, discussed in the previous section, Figure 5 shows the Joint Sponsors' two additional lines of defence during delivery:

- The P Rep – see LOD1(S) in Figure 5;
- The CRL Chair and selected NEDs – see LOD2(S) also in Figure 5.



**Figure 5. The Joint Sponsors' 2 Lines of Defence "LOD S"**

### 3.2.1 LOD1(S) – The Project Representative (P Rep)

When the Crossrail project mobilised, DfT appointed a P Rep on behalf of the Joint Sponsors to provide oversight of programme delivery, independent expert commentary, views, and advice. Deliberately, the P Rep had no authority within the governance structures – the role was intended purely as an independent early warning system for the Joint Sponsors.

In practice, although the P Rep's reports did contain relevant warnings, they did not land effectively and create a call to action by the Joint Sponsors (who under the terms of the SA had limited powers to intervene, discussed later in this

report). Interviewees often said the significance of the P Rep's warnings was hard to appreciate or became diluted by CRL's assertions and reassurances. Whatever the reason, the Joint Sponsor team found it hard to decide whether to intervene.

Before 2018 a weakness was that CRL did not have to respond to the P Rep reports. The Joint Sponsors changed that after the cost increases and delays declared in 2018.

The Joint Sponsors' contract with the P Rep included a mechanism (the Support Service Proposal) enabling deeper reviews on topics of interest. However, the Joint Sponsors rarely exercised that option.

It is hard on a project with the magnitude of Crossrail to employ a small group of people in one area and limit further engagement from the same company on other areas. To do so might deter applications for the P Rep role. On Crossrail, the Joint Sponsors were content, subject to ring-fencing against the potential for a conflict of interest, for different teams from the same company to work as the P Rep and in other areas of project delivery. The P Rep maintained a conflict of interest management plan throughout, for risk management and transparency purposes. Deemed a satisfactory way forward at the time, this whole example illustrates the difficulties in procuring highly experienced independent assurance experts on large scale long running infrastructure projects.

Many members of the five-strong P Rep's team worked on Crossrail from its start through to transfer of accountabilities to ELC in 2021. The Joint Sponsors valued that continuity, accepting the risk that the P Rep might lose objectivity, impact and independence of thought. Several interviewees raised concerns about group think and a learning point for future projects and programmes is to rotate the P Rep's staff regularly.

DfT adopted a similar P Rep model on HS2 and it would be worth taking stock of the combined lessons learned. It would be fair to conclude that the P Rep role on Crossrail did not stimulate significant corrective intervention by the Joint Sponsors. The P Rep role had no authority and required the Joint Sponsors, who had limited controls and levers, to distinguish between numerous chronic issues and identify and intervene on those problems that were truly critical.

### 3.2.2 LOD2(S) – The Joint Sponsors' relationships with the Chair and NEDs

The Joint Sponsors had the right to approve the Chair's appointment, as recommended by CRL's board. Each sponsor could also appoint at least one NED to the CRL Board.

The Joint Sponsors mostly endorsed CRL's recommendations, leading to the Chair's reappointment for a second term through to 2018. In hindsight that resulted in a weakness, because by 2018 the main priority should have been systems integration and commissioning, and the reappointment meant the Chair's skills and experience remained civil engineering centric. Further, the NEDs, although lacking new railway delivery leadership experience, were rarely rotated. Both factors became a weakness in this line of defence as the programme progressed.

Before 2018, CRL's successes delivering the complex construction scope on the COS fuelled a culture of optimism and confidence within the company. From 2016 onwards, the Joint Sponsors became increasingly concerned about the schedule's realism, but by then a culture that sought out and rewarded success had taken hold, leading to a group think situation. The Joint Sponsor, under the established governance arrangements, did not have the authority or controls to address the culture of optimism that was building up.

Following the principles set out in the PDA in which CRL had a high degree of autonomy after satisfying the conditions of the four Review Points, there were relatively few formal interactions between the Joint Sponsors and the CRL Chair and the board from the start of the project up to 2018. The normal procedure was for the Chief Executive to provide updates at the Sponsor Board meetings, their primary purpose being information-sharing and stakeholder management.

The ways of working changed significantly after 2018 with the Joint Sponsors working closely with the new Chair, the strengthened board, and others in helping the project get back on track. That arrangement proved to be effective and continued when TfL took on the lead delivery role in 2020. The conference in April 2023 organised by the APM explored and highlighted the many significant learning points from that re-set activity<sup>15</sup>.

The conclusions drawn from the findings above are that regular rigorous, structured, and informed sceptical challenge from the Joint Sponsors, accompanied by effective governance and retained powers, would have probably got more out of this important line of defence. Further, the delivery company's board should have skills and experience related to the coming phase of the project, as well as to the current phase. Finally, it is important to guard against the risks and perils of group think when designing an assurance regime.



### Lesson Learned



The sponsor should ensure that the Chair's and NED's experience and organisational capabilities match the evolving nature of the work, supplementing and replacing capabilities in anticipation of the next phase.



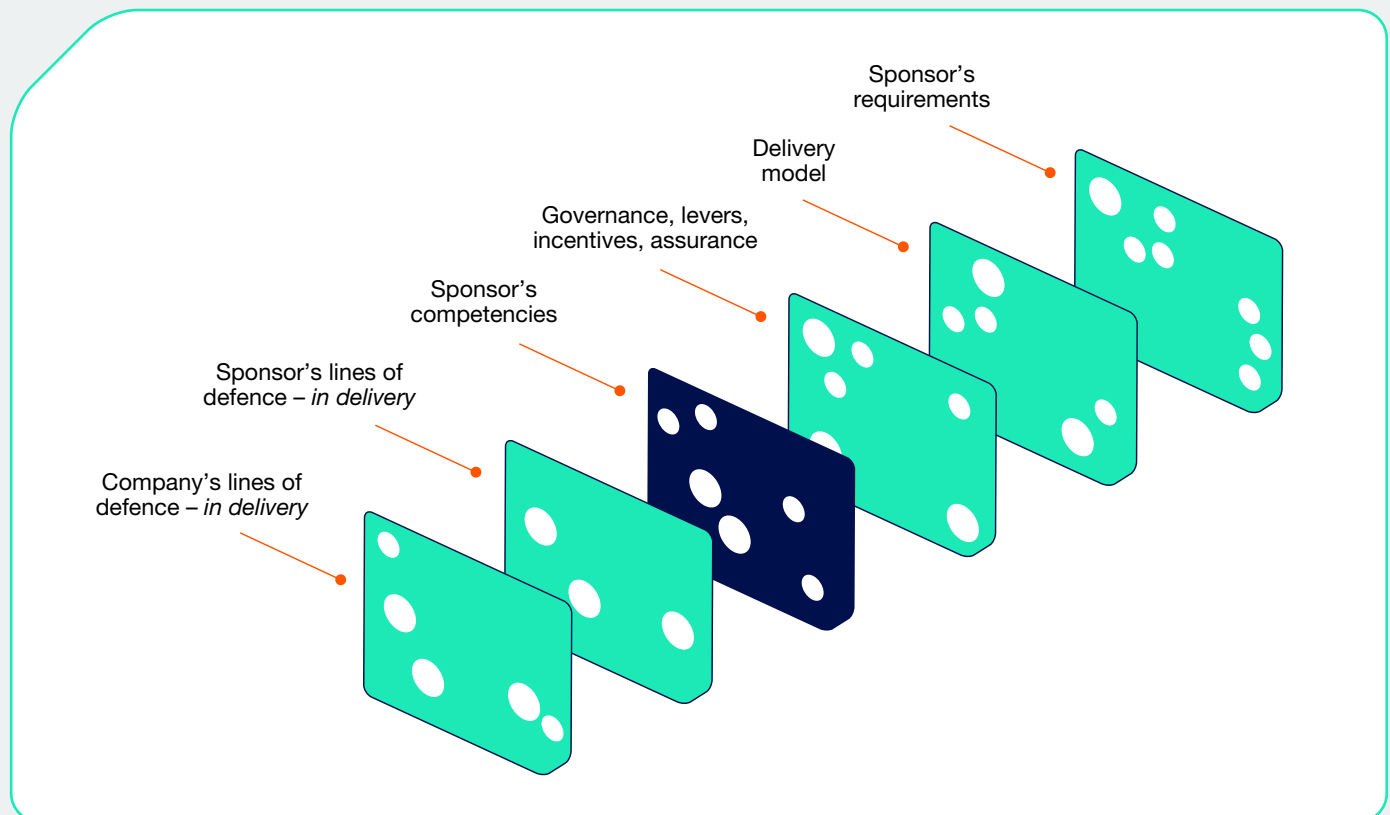
### Lesson Learned



The sponsor should design the external scrutiny and assurance to avoid group think, specifically considering both integration and entry into service as well as other project risks.



## 3.3 Joint Sponsors' competencies



Referring to the navigation pane above, this section considers the Joint Sponsors' competencies.

DfT and TfL put considerable effort into determining their accountabilities and responsibilities, enshrining them in the SA. This was a major undertaking, reflecting the multi billion pound investment both were making. TfL and DfT signed the SA in 2008, a comprehensive document drafted with the support of external lawyers. It stood the test of time without significant amendment and provided an effective, rigorous sponsorship framework. The combined capabilities that DfT and TfL brought to bear in promoting the business case through its approval gates and in setting up the SA were both strong and effective.

Another point of good practice was that the PDA, the contractual agreement between the Joint Sponsors and CRL, provided a contemporary aligned contractual delivery framework.

Most interviewees regard the effort put into the SA as time well spent and a strong factor behind the momentum achieved from the outset. The priority in those early days was to establish a free-standing arm's length delivery vehicle (CRL) led by a Chair, Chief Executive, and board with a high degree of autonomy that grew progressively through four capability-related Review Points. The idea was that CRL would earn autonomy in stages as it built up its resources as a temporary organisation comparable to a FTSE-250 company. The Joint Sponsor team and CRL took those review points seriously, both wanting CRL to achieve an effective delivery capability as soon as reasonably possible. The SA was a positive contributory factor behind CRL's strong start and to its early successes because it aligned DfT and TfL as investors.

CRL was a wholly owned subsidiary of TfL, responsible for delivery of Crossrail, under the oversight of the Joint Sponsors. The role of Chair for the Sponsor Board rotated annually between DfT and TfL. The Joint Sponsor team was the single point of contact for CRL, and the arrangement brought clarity and simplicity.

A major benefit of the SA was that it created scope stability. Sponsor-initiated scope changes were few, some seven in all, which is remarkable on a project of this scale and complexity. The Joint Sponsors acted as a mutual brake and held each other to account when assessing potential changes. This was a significant outcome, shielding the company from changes in scope or priority. When changes were necessary CRL managed the process transparently. The formality and inevitable inflexibility of that process, however, might have resulted in some missed sponsor-initiated opportunities.

“The Sponsor Board was ‘on it,’ responsive and the right mechanisms were there via the Sponsors Agreement.”

Concerns about delivery began to emerge from 2016 onwards and the Sponsor Board increasingly sought assurance from CRL that the project could be delivered as reported. In mid-2018 the Crossrail project formally declared that the target opening date later that year was no longer achievable. At that point the Joint Sponsors took decisive action to establish the reasons, the scale of the delay and the associated cost implications.

Although CRL formally announced the delay in 2018, people at all levels across the project, including members of the Joint Sponsor team, had sensed for some time that the project was

getting into difficulties. Some felt the indications were there in 2016 with many suggesting, in hindsight, that the schedule was flawed from the start.

With concern mounting, but with CRL's Executives appearing confident that all was well, the Joint Sponsor team could only challenge, probe, and push. The team raised their concerns but did not have either the personal gravitas that comes from having led and delivered complex projects and programmes or the contractual mechanisms under the SA and PDA to land the message in an organisation that was by then suffering from collective group think and that was not always receptive to the feedback. That was a crucial factor in the way events turned out.

In 2018 matters came to a head, with CRL declaring cost increases and schedule delays. The Joint Sponsors stepped in, using its powers under the SA and PDA to adjust the mix of capabilities in the CRL Board away from civil engineering and more towards systems integration and commissioning. Between 2018 and 2020 the Joint Sponsors had to engage fully, which was not anticipated under the arm's length SA construct. By all accounts those efforts worked well and by 2020 the project had been rebaselined and the cost forecast had settled, as discussed in more detail below.

In 2020 the joint sponsorship arrangements changed by agreement, with accountability for achieving live operations transferring to TfL and with DfT having a more limited role. The TfL Commissioner, in line with the shift in accountabilities, injected a sense of drive, purpose and determination. Most interviewees said this change was essential, several suggesting a transfer several years earlier would have made the system integration challenges easier to resolve. CRL conducted an operational capability / readiness review in 2015, but accountability transfer was not a major consideration. The lack of sponsor-driven capability and accountability review points is a learning point for future major projects.



The demands on the Joint Sponsor team evolved as the project progressed. The competencies in formulating the business case and promoting it through the three-stage approval process<sup>16</sup> were different from those in construction and through to systems testing and commissioning. The skills and experience mix of the Joint Sponsor team did not, however, stem from a plan with review points linking evolution of its own capabilities to the project's progress.

Any project's sponsor usually has defined accountabilities and responsibilities, a comprehensive stakeholder management and communication role, and thorough reporting and administration obligations. The art of being an effective sponsor also depends on the capability to exercise judgement derived from experience. Sponsorship is about insight, picking up clues and knowing how to read an ambiguous situation and work effectively with few available levers; in particular, it is about decisive leadership; sensing whether, when and how to engage, support or intervene.

Senior members of the Joint Sponsor team had important duties on other projects and programmes or more widely within their parent organisations, significantly limiting their time

inputs on Crossrail. Staff in the Joint Sponsor team had limited project delivery or rail operations experience. This was not an oversight; it was fully in line with the intended philosophy behind the devolved arm's length delivery model. After the costs and schedule challenges declared by CRL in 2018, the Joint Sponsors strengthened the Joint Sponsor team with the addition of technical experts familiar with railway systems and commissioning. That boosted the Joint Sponsors' capabilities and there is a learning point here about the need for such insight in the sponsor team, even in a highly devolved delivery model.

In conclusion, there were many positives about the joint sponsorship model that other major projects can learn from, especially in the way it was set up and underpinned by a solid, well thought-through agreement. The Joint Sponsors were put in place in a timely, effective way and their role was well defined, which is entirely consistent with principles published by the APM<sup>17</sup>. The main conclusion is that CRL had considerable autonomy but, even then, the highly devolved model still needed strong leadership from an experienced empowered sponsor.

## Summary of what worked well

- The right capabilities to establish the initial vision and promote it
- Strong capabilities for the business case and DfT / TfL / GLA funding solution
- Collaborative behaviours within the Joint Sponsor team and a sense of purpose
- Joint Sponsors held each other to account via a well thought-through agreement
- Reacted decisively when major problems crystallised
- Strong TfL leadership for the final push to live operations

## And less so

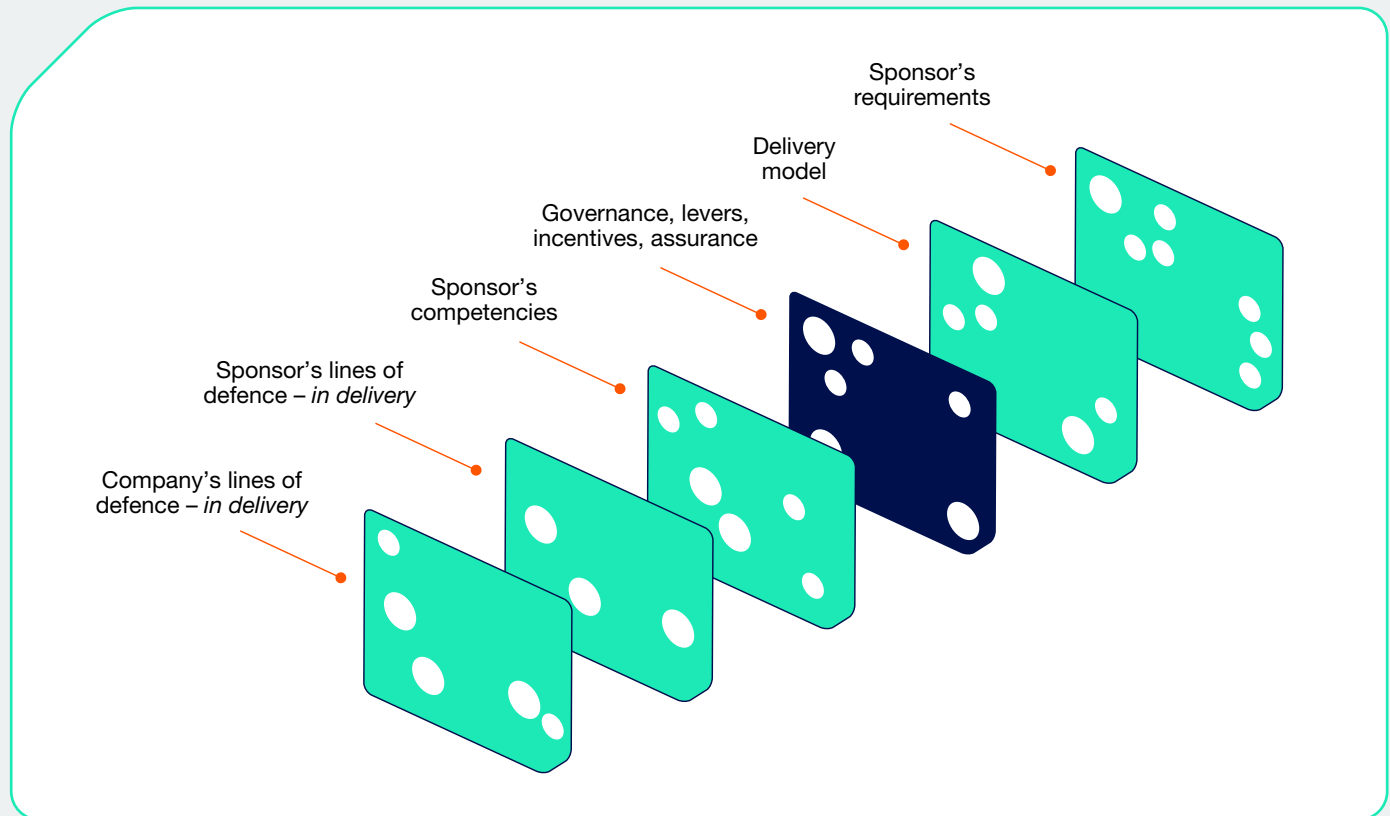
- Lack of project delivery or rail operations experience in the Joint Sponsor team
- Prone to being “batted back or out gunned” by CRL’s executives
- The Joint Sponsors were not sufficiently engaged when the project appeared to be on track
- Did not have the governance levers to pick up and act on P Rep’s warnings
- Sponsors’ capabilities were not matched to the evolving project needs



### Lesson Learned

Ensure the sponsor’s own role is clear, its people have relevant practical delivery experience and authority, and there are pre-planned capability review points at intervals aligned to the evolving needs of the project.

## 3.4 Governance and levers, incentives, assurance



This section addresses the **Joint Sponsors' governance, levers, incentives, and assurance arrangements**, as indicated in the navigation diagram above.



### 3.4.1 Governance and levers

The Sponsor Board had limited authority, within the delegation limits set out in the SA, to take decisions. The tight delegation levels meant that requests for decisions were often taken back into the parent TfL and DfT organisations for financial, political, operational, or technical assessments before giving commitments to proceed. The administration of that process worked well by all accounts.

According to interviewees, the strongest lever was “soft power” i.e. the risk to reputation or brand either personally or from a project perspective. In terms of formal levers, the Joint Sponsors had rights to request remedial plans if costs exceeded specified levels or the schedule became delayed by more than six months. The Joint Sponsors could also approve CRL’s recommendations to appoint and re-appoint the Chair and the Chief Executive Officer (CEO). All of this was in keeping with the concept of full delegation to a highly autonomous delivery organisation.

The main contract with CRL, the PDA, contained four Review Points (RPs) and three Intervention Points (IPs). The Review Points related to CRL’s maturity growth as it built up its capabilities after receiving permission to proceed in 2008. For example, as CRL progressed through the

four RPs it received greater levels of delegated authority from the Joint Sponsors to award contracts. The intention behind the Intervention Points was different, namely, to provide a set of criteria and pre-agreed actions should CRL's performance not follow expectations.

- The Review Points worked well, enabling a progressive transfer of management freedoms to the CRL organisation as its capability grew. That seems to have been an effective process in every respect, taken seriously and diligently with TfL, DfT and CRL intent on building up CRL's capability and capacity as soon as was reasonably practicable.

“The Review Points had real teeth and were important to us, so we put a lot of effort into preparing for them.”

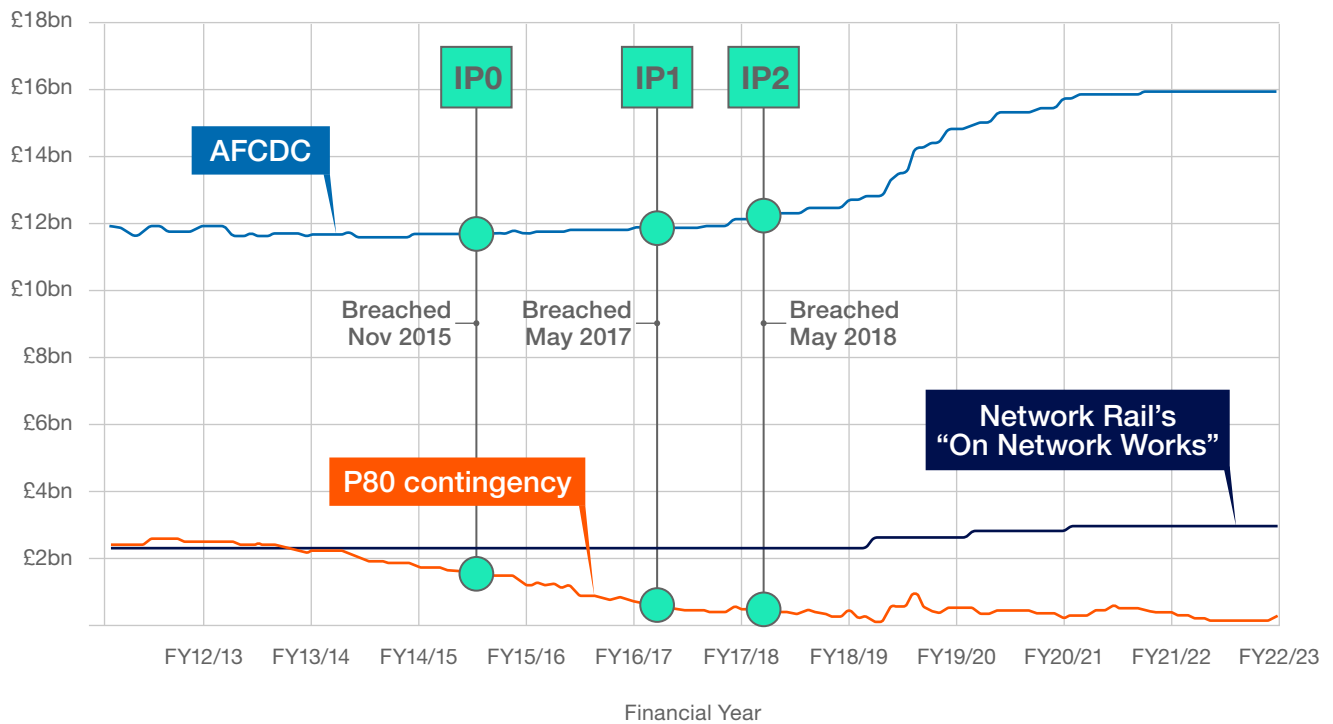
- The Intervention Points were less effective. Their purpose was to provide early warning and trigger recovery or remedial actions upon breach of predetermined total anticipated cost forecast thresholds. In the event, they did not do that.

Figure 6 shows the intervention points in relation to the monthly AFCDC (Anticipated Final Crossrail Direct Cost) forecast and the level of unused P80 contingency funding. Two points have particular relevance:

- The AFCDC headline forecast did not significantly rise for the first six years, because consumption of the contingency funds masked what would otherwise have shown up as a headline cost increase.
- CRL's solution-seeking culture often resulted in initial rejection of contractors' rising costs and slipping schedule forecasts, in the hope of implementing mitigation measures. Those were, however, often not feasible, resulting in a time-lag before CRL included the new information in the forecasts.

Under the contractual provisions of the PDA the first Intervention Point, IP0, enabled the Joint Sponsors to express dissatisfaction and ask for submission of a recovery plan. IP0 did not confer step-in or intervention rights. IP1, triggered in May 2017, enabled the Joint Sponsors to take direct action, but by then any scope reduction, value engineering or phasing options had shrunk to insignificant levels.

IP2 enabled either the Secretary of State for Transport to exercise a call option or TfL to exercise a put option, to transfer ownership of CRL to the Secretary of State. However, this binary choice was found to be impractical at such a late stage in the project. The PDA did not provide a useful framework for resolving the breach of IP2 or agreeing the additional funding required to complete the project.



**Figure 6. Cost forecasts, contingency use, and the 3 Intervention Points**

There are significant learning opportunities for other major projects, based on the Crossrail experiences noted above.

- Well-designed Review Points can help a fledgling organisation grow in a managed way, as was the case with CRL.
- Great care is necessary when designing Intervention Points, which should detect and reveal problematic trends at an early stage in a project's lifecycle while there are still chances of optioneering and course corrections. In Crossrail's case the IPs' weakness was that contingency drawdown suppressed upward movements in the headline costs for many years, delaying the Joint Sponsors' intervention.

Ideally intervention triggers should tie into:

- baselined contingency-free cashflow forecasts;
- the rate of contingency consumption;
- unambiguous milestones; and
- external assurance outcomes.

The Crossrail project also raised some questions or considerations about the role of the Senior Responsible Owner (SRO) versus the role of the sponsor on major infrastructure investments. The principle for government-funded projects, broadly speaking, is that the sponsor sets the vision, establishes a mandate, secures the funding, and sets and monitors the requirements and benefits. The SRO, under the terms of the normal SRO's appointment letter, is then accountable to Parliament for delivery.

On Crossrail that principle was not as straightforward as the plain concept would suggest, because the government provided only around 30% of the funding for the project. The SRO sat in DfT, but the remaining 70% of the funding came from businesses and future fare payers, primarily via the business rate supplement and TfL and GLA funding/financing. TfL is accountable to the Mayor of London, ultimately, not central government and thus not normally subject to central government approvals. Delivery accountability for the integrated programme was thus partly via the government-appointed SRO to Parliament and partly through others to their respective authorities.

Interviewees expressed confusion about the authority of the SRO in this arrangement, especially as the Sponsor Board was the authoritative governance body at the top of the contractual delivery model. CRL, a subsidiary company of TfL and the empowered arm's length delivery vehicle, had most of the accountability for delivery delegated to it. CRL had duties under the Companies Act with regard to running its business as a legal entity, with responsibilities to its employees, shareholders, and stakeholders. The combination of these factors reduced the clarity of the SRO's role and is worthy of further consideration on future co-owned capital projects and programmes.







### 3.4.2 Incentives

The TfL Shareholder Agreement set out the Remuneration Principles; in 2010 the CRL Remuneration Committee further developed the detail and the processes, as set out in the Remuneration Framework. Each year CRL's executives worked under a strong set of financial incentives determined by the CRL Remuneration Committee, having first consulted TfL. Typically, the bonus potential was between 100% to 200% over the base salary. Incentives were usually linked to in-year targets and rarely to overarching completion and opening of the railway and neither TfL nor DfT had an input in setting Key Performance Indicators for CRL, such as the "hands off" nature of the relationship with the arm's length body.

It is not easy to offer an alternative, because a more direct role in setting remuneration and bonus levels might weaken the concept of a free-standing project delivery vehicle. A workable solution on future similar projects might be to include bonus limits or principles in overarching framework agreements, thus providing some contractual constraints or guidelines relevant to the scale of potential bonuses.

The delivery suppliers were responsible for producing outputs, not outcomes. It was CRL's role to integrate the component outputs, leading to the main desired outcome, namely successful railway operation.

The delivery suppliers initially worked under incentivised target cost pain-gain contract mechanisms governed by CRL. Gradually those arrangements fell away because there was

extensive slippage on many of the individual work packages, with causation unclear, rendering the incentive framework difficult or impossible to operate. By 2016 most suppliers were working under cost reimbursable arrangements, supplemented by completion bonuses. There is no single reason for that switch, but interviewees cited the complexity, the number of changes taking place at a working level and the sheer scale of the Crossrail project. In hindsight this offers a learning opportunity about the design of incentive regimes; it was not the intention under this delivery model for the Joint Sponsors to have control or oversight of the execution of the incentive regimes, but there would have been an opportunity to set out the principles of a more effective incentive regime in the SA and PDA documents.

The reimbursable nature of the contracts created an incentive for the suppliers to overstate progress or prolong their work; it was up to CRL's project delivery partner and the project managers to detect that and iron out any such behaviours.

There were no incentives on the contractors relating to integration or to opening of the railway. Their incentives were mainly related to achievement of their own scopes of work. As such the incentive regime perversely encouraged presenteeism, endurance and siloed ways of working. Again, it would defeat the purpose of establishing a free-standing arm's length body for the Joint Sponsors to play a role in that incentive-setting process, but including some bonus principles or limits in the PDA would emphasise the importance of programme integration and railway opening rather than individual work package completions.

### 3.4.3 Assurance

The lack of an assurance regime covering both technical and programmatic integration was a weakness. The assurance requirements by authorities such as the ORR and the London Fire Brigade were significant. In hindsight CRL should have provided greater prominence and time allowances for assurance in the schedule from the outset.

Although this was primarily an issue for the CRL Board, the Joint Sponsors should also have asked for regularly updated Integrated Assurance and Approval Plans (IAAPs) in the Sponsors Requirements, and checked, either directly or via the P Rep, that CRL's schedule reflected the required scale of the external assurance work. An IAAP became a general TfL requirement in 2013<sup>18</sup> but by then CRL was up and running and this requirement was not added to the PDA.

The IPA's independent assurance reports in 2015 and 2017 rated the project as "Amber/Green". In 2017 and 2018 CRL commissioned two separate and more intense independent assurance reports from experts in the private sector, but these did not foresee the scale of the integration challenges either. KPMG's in-depth scrutiny in 2018, published in 2019<sup>19</sup>, took stock of the known costs but similarly found it challenging to forecast the impact of the remaining risks.

While excessive assurance can create other problems, there is a lesson to consider from all of the above about the effectiveness of the external assurance process, in particular whether fewer, deeper, more intrusive assurance reviews led by highly experienced people with recent relevant practical hands-on railway delivery experience, able to judge the cost and schedule risks based on their own experience, would be more effective and reduce the total assurance burden.

#### Summary of what worked well

- The four Review Points progressively transferred delegated authorities and freedoms to the fledgling CRL organisation

#### And less so

- Intervention Points were triggered later than was useful, because consumption of contingency funds created a buffer delaying the warning
- Limited consequences of breaching the first Intervention Point, under the SA
- No joint sponsorship principles or criteria in the PDA about setting senior executives' targets and bonuses
- Incentives for the delivery contractors tended to operate on a package by package basis rather than driving towards integration or opening of the railway
- External assurance leading progressively to entry into service did not see, or call out, the problems clearly enough

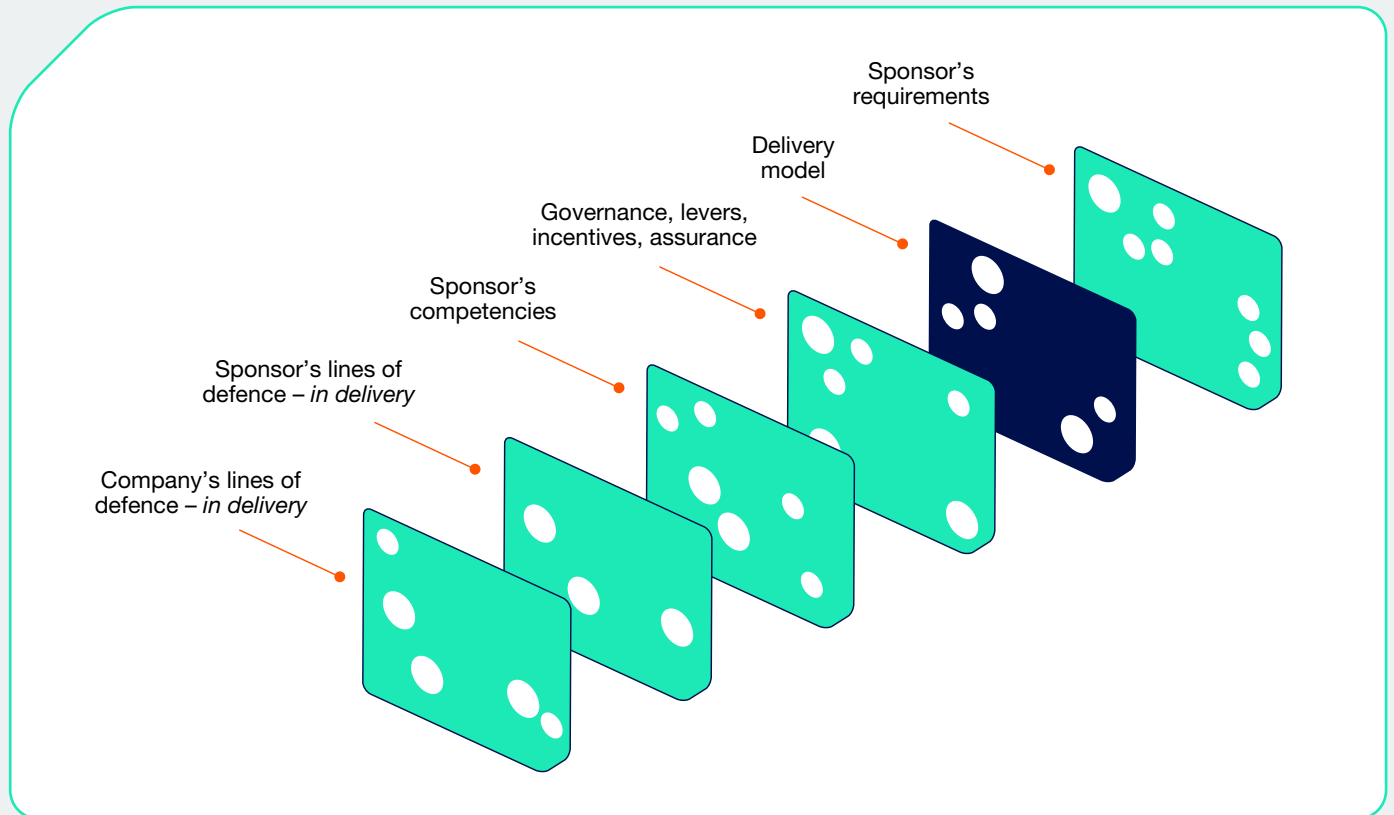


#### Lesson Learned

At the project's outset the sponsor should configure the governance, levers, and incentives to encourage solution integration and entry into service.



## 3.5 Sponsors' integrated delivery model

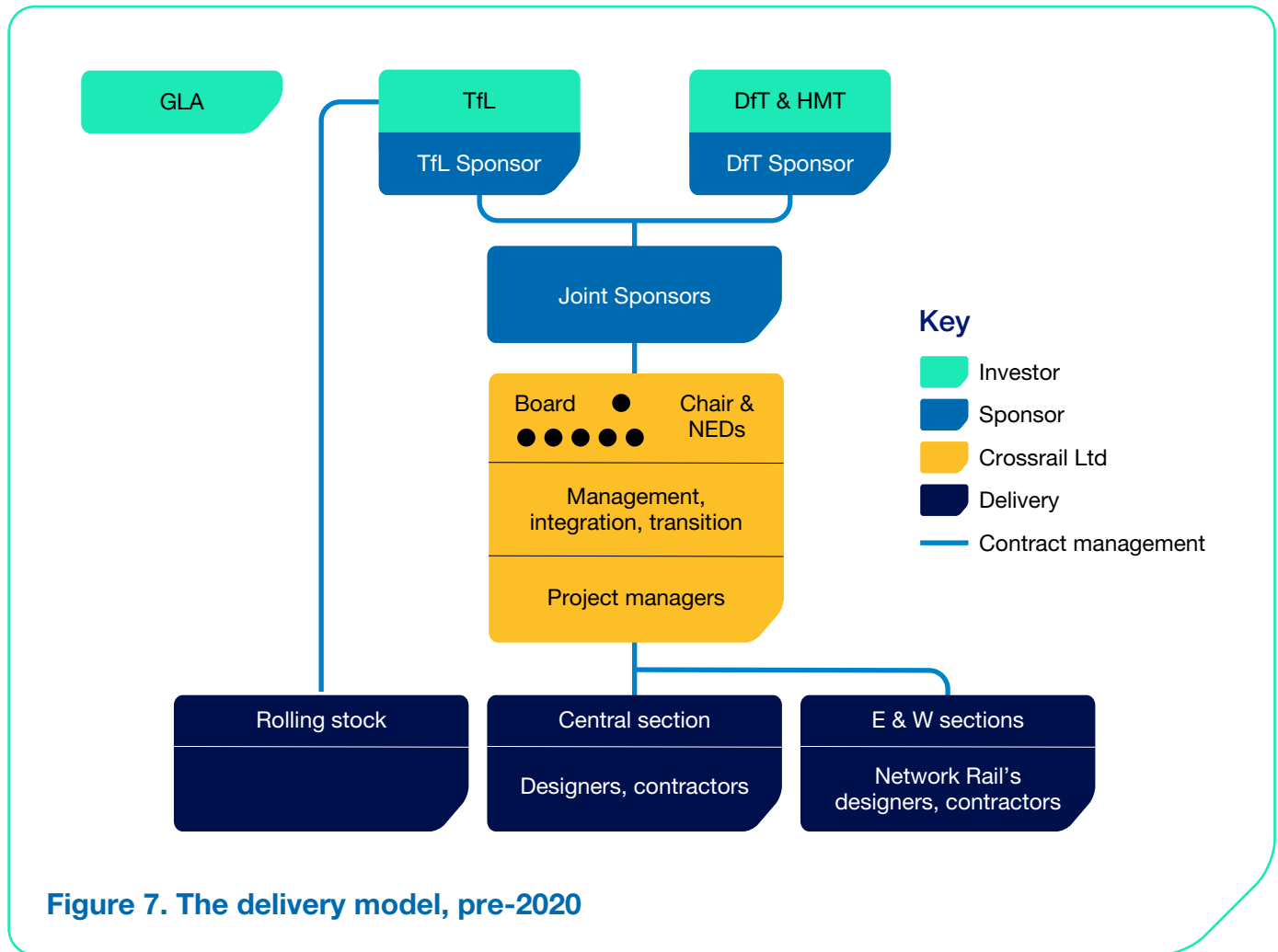


This section addresses the Joint Sponsors' delivery model, as indicated in the navigation diagram above.



Figure 7 depicts the main delivery model. This structure prevailed from the outset and lasted until accountability transferred to TfL in 2020. The Joint Sponsors instigated several key personnel changes in 2018 but the delivery model stayed stable throughout that period.





The Sponsor Board brought together the interests of the two main sponsor organisations, namely DfT and TfL. There were four voting members, two each from DfT and TfL. The board and its support function typically comprised 10-15 people, led at director general level or equivalent from DfT and TfL. As mentioned earlier, the concept was for the Joint Sponsors to be in an oversight / monitoring mode for most of the time, with full delivery authority afforded to CRL. In the early days of mobilisation CRL's powers were relatively limited, but they increased under the concept of "earned autonomy" via four Review Points under the PDA arrangement as previously discussed.

Under the broad framework shown in Figure 7, CRL was able to set out and implement its preferred approach to recruitment, procurement, project management and commissioning.

CRL established a board, to which TfL and DfT each had the rights to nominate at least one representative NED as well as approving CRL's recommendations for the Chair and Chief Executive posts.

The bulk of the delivery model depicted in Figure 7 made excellent sense and is worth considering for other complex multi-party infrastructure arrangements. We explore three topics of interest here:

- The rolling stock
- NR's positioning
- The GLA's role



## Rolling stock

The rolling stock procurement and delivery required significant coordination effort and personal dedication from key contractors and individuals.

CRL ran the competition for the rolling stock, after which TfL took on responsibility for its delivery and contract management. This was sensible because TfL would have control from day 1 of the 30-year operating contract for the rolling stock, and this approach avoided a contract novation process at the end of CRL's existence. It would also be in a strong position to orchestrate and manage a limited transitional service in the early years of operation. The rolling stock was at the heart of the TfL-led operating model and proximity to the future operator was vital, given the complex transitional arrangements in testing the assets and training the operating staff.

According to many interviewees, the rolling stock delivery was complex, challenging and ran later than planned. This did not cause a delay to the critical path, but it did have the effect of increasing the volume of activities in the final testing and commissioning phases. Bombardier (latterly Alstom), who were delivering

the rolling stock and its on-board signalling communication systems, required intricate and precise coordination with Siemens, who were responsible for providing the trackside signalling and communication systems in the central section. The NR interfaces for the signalling systems on the east and west sections and from the airport junction also needed to be integrated with the train systems.

The funding structure and delivery model for the rolling stock was originally expected to follow a PFI-type of design-build-commission-operate arrangement. At the time HMT was interested in PFI or ROSCO (Rolling Stock Leasing Company) types of solution and was encouraging CRL to consider such options. However, by 2014 PFI was beginning to fall from favour in the UK and assessments of CRL's options suggested poor value for money and raised concerns over unacceptably long times to conclude the financing agreement as well as for delivery. These considerations came at a relatively late stage in the project, given the intended 2018 railway opening date. Had the main Crossrail project not run into difficulties, several interviewees felt that the rolling stock, and consequently the signalling, would have been on the critical path.

The operational control system for Crossrail was an amalgam of lineside and train borne sub-systems from different suppliers and under different contractual management arrangements. The train was, in effect, the hub for the integration of these systems. To help strengthen coordination the CRL Ops Director had dual reporting lines, to CRL and TfL, but nevertheless the situation remained highly complex and challenging.

### NR's positioning

NR was positioned under a protocol agreement signed in 2008 as a supplier to CRL within the project delivery architecture. NR had three primary roles: first, as a provider of new or upgraded stations and infrastructure on the Anglia and Great Western rail networks; second, as a major participant in systems integration relating to operations and through-running of the service; and third, regarding passenger timetable adjustments ahead of the new services going live.

Many interviewees felt it would have been helpful to consider NR's three roles separately and expressly reflect them in the governance and management arrangements of the integrated delivery model. The feedback was that more

should have been made of the DfT-NR day-to-day relationship to help position NR's contribution, role and fit within the integrated governance arrangements.

### The GLA's role

The GLA was a funder and, like HMT, was not one of the Joint Sponsors. Working within the Mayoral decision process, the GLA was urgently drawn into the challenge of finding and approving additional funding when the cost envelope came under pressure, first in 2018, and then in 2019, 2020 and 2022. There wasn't a pre-determined process for dealing with the cost over-runs and the solutions required efforts under pressure by the GLA, DfT and HMT. A learning point for other major projects would be to think through and put in place at the outset a formula or protocol between the investing organisations for sourcing additional funding, should that be required.

The GLA also had significant community and business stakeholder interests along the line of the route. Figure 8 illustrates the interests of the GLA, TfL, DfT and NR, showing firstly the investor community and secondly the delivery community.

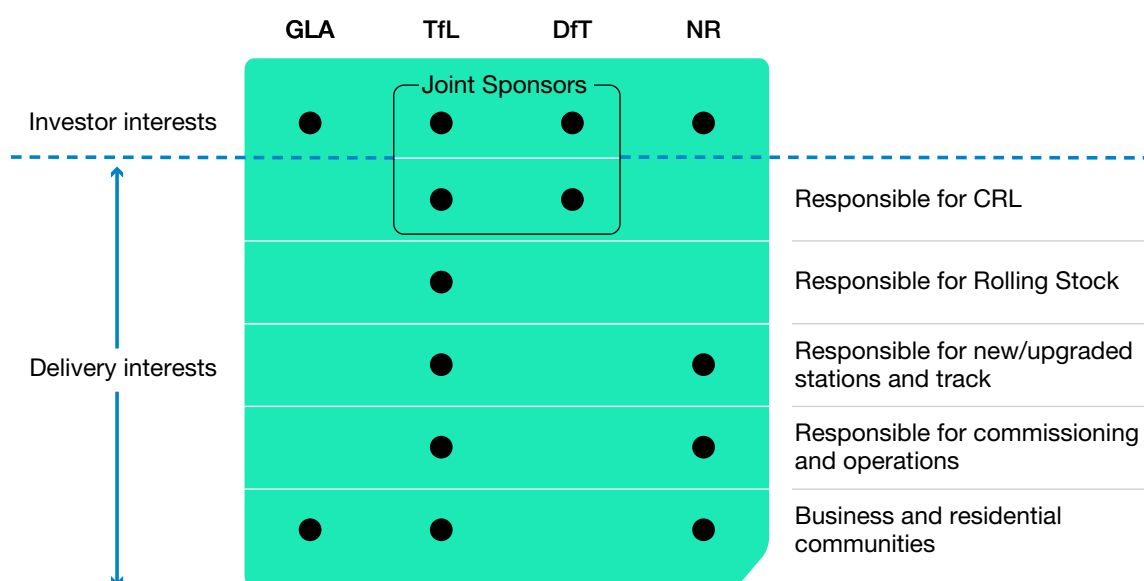


Figure 8. Key interest areas

## The dynamics of the integrated delivery model arrangements

A problem highlighted by many interviewees was the tight cadence of the governance and reporting cycles. CRL's comprehensive monthly board reports preceded the P Rep's report; both inputs informed the Joint Sponsors' management and governance meetings.

When the Joint Sponsors strengthened CRL's management between 2018 and 2020, it took the opportunity to streamline the reporting process. The Joint Sponsors' progress update meetings immediately followed the CRL Board meetings, thus cutting the communication times and ensuring an immediate alignment of understanding in a fast-changing situation.

The sponsorship arrangement further changed in 2020, with the lead role passing to TfL. The transfer of accountability enabled TfL's new Commissioner to drive the completion phase from an operational viewpoint. TfL's focus on achieving live operations helped considerably and many interviewees considered that the switch to an operator led 'pull' should have occurred sooner, although it is questionable whether TfL would have opted for that in the light of the problems that became apparent in 2018.



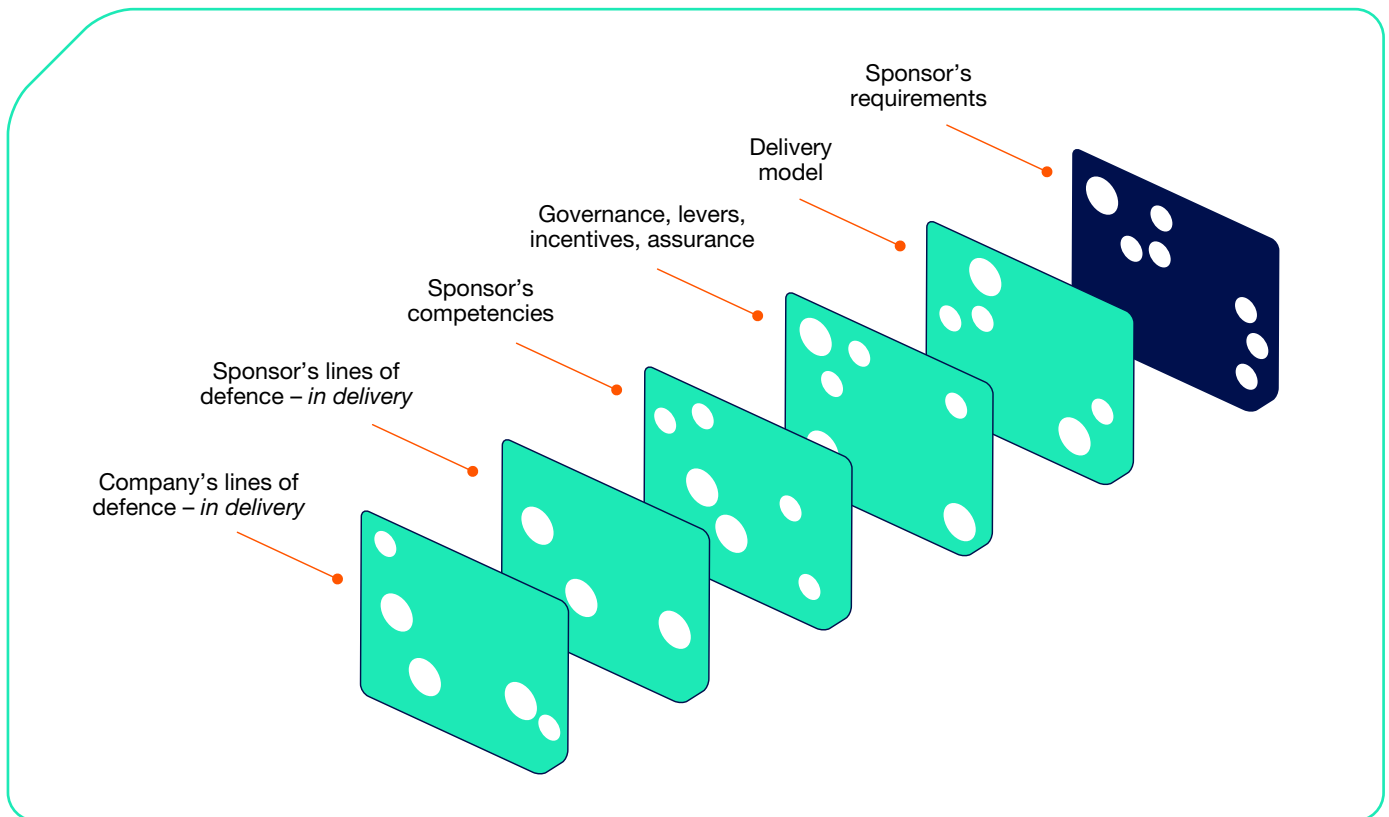
### Lesson Learned

Having created a delivery model for the project at the outset, the sponsor should formally review and adapt it at intervals.





## 3.6 Sponsors Requirements



**The Joint Sponsors, supported by technical experts, established a short, concise set of requirements at the outset, as part of the business planning and approvals process. This outcome-centric approach was excellent practice and stood the test of time as an enduring reference document.**

It was a conscious decision (under the SA and PDA) that the Joint Sponsors would have a limited involvement in the translation of the Sponsors Requirements into the development of the detailed functional solutions, specifications, and scope interpretations. That responsibility lay with the board of CRL and, with hindsight, was an opportunity missed as the Joint Sponsors were insufficiently aware of, or engaged with, the increasing levels of system complexity and associated costs and risks.

Value Engineering exercises concentrated more on removal of high-cost scope items, such as connection tunnels, rather than simplification. Interviewees commented that the project proceeded with few standard or repeatable designs, often involving multiple contractors for broadly similar work (e.g. nine lead contractors building ten stations) and with high levels of system complexity. Those design solutions were essentially CRL's, but it is striking that the Joint Sponsors had no formal say in the matter, but on completion remained accountable for the cost and had a responsibility for managing and maintaining those systems.

The costs of the Sponsors Requirements were matured in the Full Business Case development process in the years running up to approval in 2008. Estimating the costs of a project that would take more than a decade to deliver proved particularly challenging, despite concerted efforts to assess risks and their likely impacts. The early procurements took place in the

aftermath of the 2008 global financial crisis and there was a risk, fully recognised by CRL, that the market conditions were such that the contractors would price their bids tightly with a view to gaining entry to the project with some expectation of future cost claims.

The early procurements resulted in an apparent saving of around £1 billion which, in hindsight, should not have resulted in the budget for the project being reduced, since the risk profile had either remained unchanged or had worsened. Whilst it is useful to identify savings opportunities, there is a lesson here about false economies and both HMT and the sponsor maintaining a realistic view of risks and protecting the project's funding envelope.

Under the spotlight from the press, politicians, and stakeholders, the 2018 target opening date, specifically set in the PDA and reflected in the SA, became an immovable milestone against which trade-offs were not countenanced, despite sceptical challenges from the Joint Sponsors. Modern best practice points toward the use of ranges rather than specific delivery dates, particularly on high risk / high uncertainty programmes that span decades.

In 2010 the solution was inevitably high level and several years of design development work would be required for a credible schedule to emerge. As 2018 approached, people at all levels across the project, from the Joint Sponsor team to CRL's project managers working on the stations, were aware of the growing pressures on the schedule. An electrical failure at the Pudding Mill Lane facility provided a valid and credible opportunity to re-set the schedule, but CRL held to the stated date. The stance required from CRL and the Joint Sponsors should have been one of realism, flexibility, and expectation management, rather than sticking to the target in-service date set in the PDA.

A suggestion in the DfT / IPA 24 Lessons Learned paper, and being adopted on HS2, is to communicate a range of dates within which completion is likely to occur, rather than presenting a single target date to stakeholders. That technique was never more needed than here, potentially avoiding the consequences of the unrealistic immovable deadline. From 2018 onwards CRL, under the new Chair's direction, and the Joint Sponsor team began to refer to an opening window, helping manage expectations with stakeholders and avoid unnecessary precision and pressure. Meanwhile in the background, the Joint Sponsor team pushed for, and the new CRL Board and management strove to drive performance to, a deterministic schedule.

One final point associated with the Sponsors Requirements is that there was a notable challenge on Crossrail associated with the poor definition of asset data and the asset data management processes. The significance of this became clearer as the time for testing and assurance relating to entry into service approached, when it was discovered that the contractors' data had inconsistencies and gaps. Many tests were repeated and the "paper trail" had to be recreated. Suppliers had their own individual methods of recording asset creation and test data, and holistic integration was challenging. A clear requirement from the Joint Sponsors relating to creation, standardisation, integration, and maintenance of asset data would have avoided much retrospective data assembly work later in the project, often taking place when the relevant contractors had left the project.

"Everyone on the ground knew about the delays, but it was in nobody's interest to say."

## Summary of what worked well

- Outcome-based requirements that stood the test of time
- Comprehensive stakeholder support throughout inception and delivery for the requirements, embracing central and local government and businesses and communities along the route
- Few changes in scope or requirements during the 12+ years of delivery

## And less so

- Complexity rose without purposeful engagement with the Joint Sponsors in translating the requirements into functional specifications under the deliberately “thin client” model
- Asset data requirements not set at the outset or updated after that by the Joint Sponsor, and integration of asset data was challenging
- CRL’s design development and construction management processes were outside the Joint Sponsors’ line of sight or control
- Heroic 2018 target completion date fixed too early, with inadequate stakeholder expectation management from CRL and the Joint Sponsor team





### Lesson Learned

The sponsor should own clear outcome-based requirements, staying sighted and accountable at pre-agreed decision points as the project delivery organisation translates them into detailed functional requirements.



### Lesson Learned

Even in a highly devolved delivery model, the sponsor should maintain sight of and manage, or at least formally agree to, material scope, schedule and cost trade-offs arising through design and construction development throughout the project's life, informed by the benefits realisation impact.



### Lesson Learned

The sponsor's requirements should stipulate integrated digital asset management data in design and construction.

## 3.7 Sponsor arrangements on other major projects

In considering sponsor's competencies, it is interesting to compare and contrast the approaches taken to sponsorship on other major projects. The joint sponsorship arrangements on Crossrail, counting people in DfT and TfL, usually ranged between 10-15 people. In contrast the sponsor team for HS2 was some 160 strong (before the announcement cancelling the northern legs). However, 65 were undertaking direct sponsorship, similar to Crossrail's Joint Sponsor team, whilst the majority were responsible for wider sponsorship functions such as business case development and benefits management, as well as core departmental functions such as making legislation, working with Parliament and communications. The sponsor team on TRU is growing, approaching 50 people. On LTC the sponsor team is typically under five people, with the sponsor and delivery team co-located. There is no obvious link between project value and the size of the sponsor unit, and the dominant determining factor may turn out to be the scale of the retained powers.

It is worth noting that National Highways is a long-standing and experienced delivery organisation, set up to deliver road projects that are less complex than new rail schemes. They have significant repeatable elements and fewer systems integration challenges. A difference between National Highways schemes and Crossrail is that third parties such as the Driver and Vehicle Standards Agency can have an impact on outcomes, so programme integration responsibility could be considered as resting with DfT.

NR interpret the role of the sponsor differently, using the terms "Client" and "Sponsor" in a way that contrasts with Crossrail's situation. In NR's parlance the Client is what this paper refers to as the Sponsor and NR's use of the word Sponsor relates to a role positioned at a more detailed level in the delivery organisation, often engaged in the development of the detailed functional requirements. The other main difference between NR and TfL is that NR does not own its rolling stock; that changes the whole dynamic and the sponsor role is understandably different.

Designing the governance and resourcing arrangements for a project's sponsorship function will depend on its complexity, levels of delegated authority and other circumstances. Larger sponsor units might encourage duplication leading to high volumes of potentially low value-add question-and-answer work. Smaller units might be more agile but might miss key risks or not have the capabilities to interpret the situation. Whilst there appears to be no one 'off-the-shelf' answer to this question, the views expressed steer one towards a smaller and highly skilled sponsorship team.

4



# Conclusions



**The Crossrail project illustrates just how important the role of the sponsor is in determining the outcome of a major project. There were a wide range of delivery models available for Crossrail and for the good reasons outlined in this report the collective decision was to create a highly capable, autonomous arm’s length delivery vehicle.**

As with any arm’s length body, effective supervision and governance was an enduring requirement and it was still important for the sponsor to have strong capabilities, supported by the right levers, to read the situation and intervene from time to time as the project got underway, as the design developed and as risks began to mature.

A key learning point brought out from this review is that the sponsor should be proactive and keep the delivery model under constant review, adjusting it from time to time in the light of progress and emerging risks. That applies as much to the sponsor’s own team as to the wider delivery model and associated organisational arrangements.

An important consideration is how and where to find people who are suitably qualified to take on the lead sponsorship roles. Positioned at the top of the project ecosystem, a sponsor needs to draw on a combination of strong, recent, and relevant practical delivery experience, senior stakeholder management skills, credible sector experience and astute leadership skills. The Civil Service career path does not regularly produce such people and potential conflicts of interest may deter private sector organisations from expressing interest in a sponsorship role. The challenge is to attract such highly experienced people into the Civil Service model and retain them.







# Annex 1 – Methodology and list of contributors

## a) Methodology

Two independent external reviewers, Matthew Symes and Rob Brighouse, have led this Lessons Learned exercise, supported on an administrative basis by a part-time team of five people from DfT helping with data gathering, interview and workshop management, analysis, and report production.

After a mobilisation period in September 2022, the bulk of the research took place in October and November 2022.

To gain a comprehensive understanding and to develop a balanced set of recommendations covering the various phases of the whole project lifecycle, the review team carried out 90+ interviews with people representative of the phases and organisations involved at the time. To encourage candour, those interviews were on a “Chatham House” basis.

Data relating specifically to the Crossrail project was gathered in advance of each interview by means of a short survey form, mostly with some open questions about lessons learned and secondly asking for an assessment of performance against the DfT/IPA 2019 paper (“Lessons from transport for the sponsorship of major projects”).

The review team also consulted other infrastructure projects, to gain an insight about the extent that lessons were transferring from Crossrail. The team obtained feedback from HS2 Ltd, TRU and LTC.

As well as deriving data from the confidential interviews, the review team ran three workshops with 10–15 attendees to elicit further information “in the round” and help inform the thinking. Further, the Elizabeth line committee contributed to the thinking, convening a meeting on 9 May 2023 to discuss the emerging recommendations.

The draft of this report underwent a two-stage scrutiny process, firstly internally via DfT, TfL and the IPA and then externally with the support of peer review teams in the APM and MPA.

Throughout the exercise a Steering Group provided oversight and suggestions to the review team:

- Alan Over – DfT
- Rachel McLean – TfL
- Becky Wood – IPA
- Harris Vallianatos – DfT

Sincere thanks go to all those involved in making contributions to this report.

## b) Contributors

The following list shows the interviews, in the sequence of the review, often determined by individual availability and traceability.

Some of the interviewees also contributed to three workshops:

1. Joint Sponsors' perspective
2. Sharing of learning with other major projects
3. CRL's / delivery perspective

Interviewee	Attending workshop	Perspective sought
Onesan Okunpolor		DfT sponsor team
Victoria Tomalin	1	HMT Spending Team
Bernadette Kelly	1	DfT Accounting Officer and previously Sponsor
Bogdan Lupu		NR Sponsor
Alex Luke	1	DfT Sponsor team
Andy Pitt	1	DfT nominated NED, CRL Board
Paul Mansbridge		DfT HS2 Sponsor team
Kathryn Cearns		NED of CRL Board / Special Representative ELC
Alan Over	2	DfT HS2 Sponsor
Robert Jennings		DfT nominated NED
Barry Long Fred Drury Iain Nunn	2	P Rep, Jacobs
Simon Adams	1	TfL Sponsor
Chris Curtis		NR Sponsor Crossrail 2
David Hughes	1	TfL Sponsor / DfT Rail Director General
James Hampson		P Rep, Jacobs
Phil Gaffney		CRL Board
Jim Richards		DfT
Becky Wood	1	DfT and IPA
TC Chew		Arup
Polly Payne		DfT Sponsor
Graham Stockbridge		DfT Sponsor
Kenny Laird		TfL Sponsor team
Andrew Wallace		TfL Sponsor
Iain Smith Sabina Kola		HS2 systems integration

<b>Interviewee</b>	<b>Attending workshop</b>	<b>Perspective sought</b>
Richard Jordan Mark Howard		HS2, Chief Engineer, assurance
Colin Prime		NR ONW lead
Robert Devereux		DfT Accounting Officer
Ian King		DfT NED, DfT Investment Portfolio and Delivery Committee
Nicholas Woodbridge		DfT Client Team, Great Western Upgrade
Matthew Lodge	1	DfT Sponsor / SRO
Nigel Holness		MTR
Tony Poulter		DfT NED
Ellie Burrows		NR Anglia Route Director
Stephen Hill		P Rep, Jacobs
Mark Wild	3	CRL Board / CRL CEO
Mike Gerrard		Crossrail 2
Howard Smith		CRL / TfL
Richard Schofield	3	MTR
Andy Byford		TfL Sponsor and Commissioner
Alex Milbank		IPA
Neil Holm	2	NR
Jim Crawford	3	CRL
Chris Sexton	3	CRL
Emma Head		HS2 Safety and Assurance
Nick Smallwood	1	IPA
Tim Smart	2	HS2
Dave Canham		Rail for London Infrastructure
Alison Munro		TfL Sponsor team
Chris Binns		CRL Chief Engineer
Rachel McLean		CRL/TfL CFO
Mike Gallop		NR
Mark Hopwood		Great Western Railway
Gordon Masterton		P Rep, Jacobs
Solene Delion Luke Webster Martin Mitchell		GLA, corporate finance, funding
Lee-Anne Murray		NAO
Martin Buck	3	CRL

<b>Interviewee</b>	<b>Attending workshop</b>	<b>Perspective sought</b>
Chris Rayner Nasser Majothi Giles Thomas		HS2 programme integration
Farha Sheikh		DfT TRU
Neil Kirkwood		NR
Keith Atkinson		ORR
Lucy Chadwick		DfT Sponsor
Tony Meggs		IPA and CRL
Baney Young	2	NR Sponsorship
Rob Scopes	3	Deloitte
Simon Wright		CRL
Heidi Alexander	1	GLA and TfL Board
Richard Powell Michael Kent	3	KPMG
Andy Mitchell		CRL
John von Wentzel		DfT Corporate Finance
Sir Terry Morgan		CRL
Victor Fornes	1	CRL / ELC
Martin Stuckey	2, 3	TfL
Sarah Johnson		CRL
Keith Sibley		Bechtel
Pav Jhalli		DfT Sponsor team
Paul Illingworth	2	IPA
Mark Fell		CRL
Rob McIntosh		NR MD Eastern Region
John Reed	2	NR
Mike Brown		TfL Sponsor and Commissioner
Kim Kapur		TfL
Stuart Mills		CRL
Andrew Wolstenholme		CRL
Alexandra Batey	1	TfL
Stuart Harvey		TfL
Stuart Westgate		CRL
Richard Zavitz		TfL

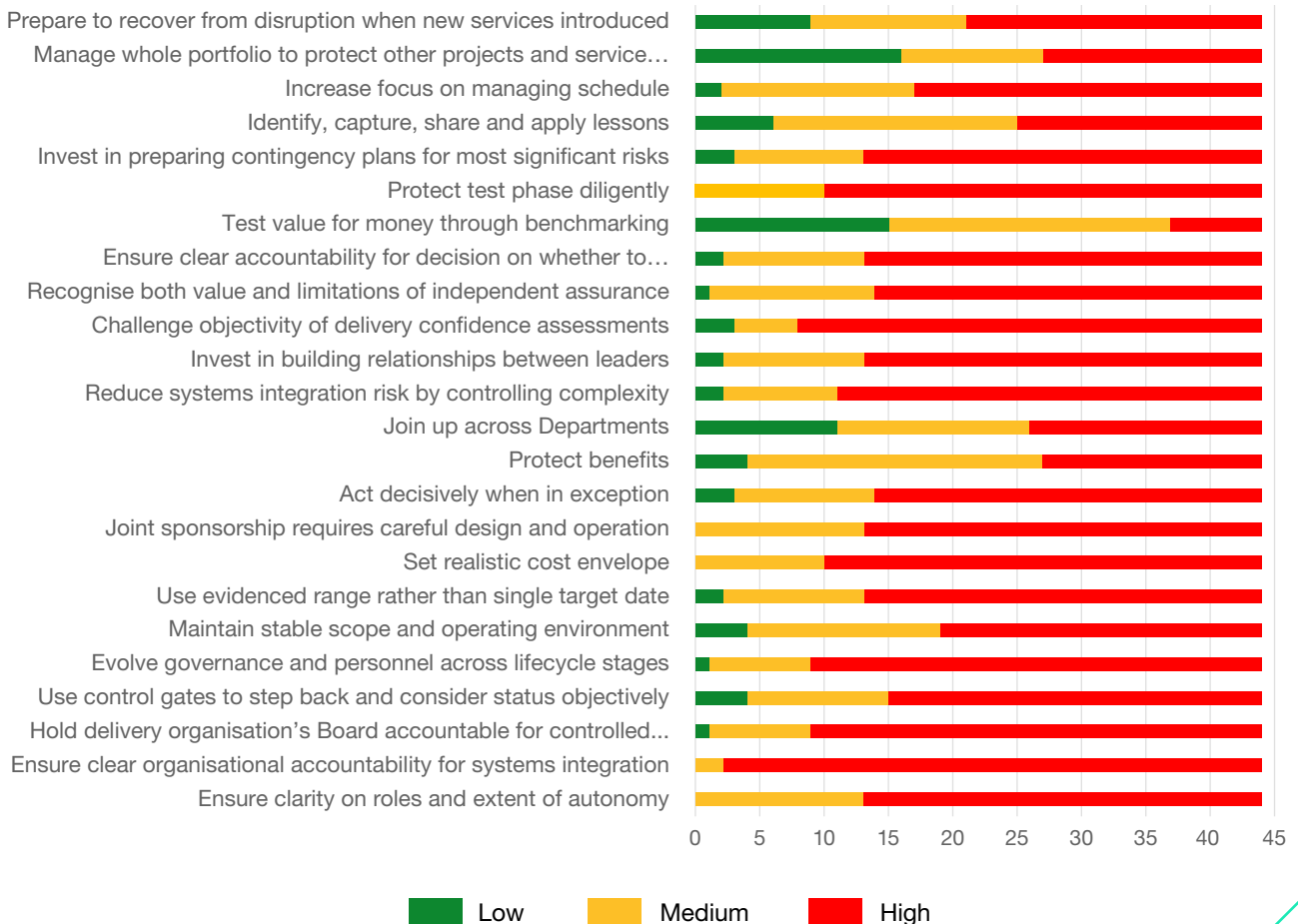
# Annex 2 – The “24 Lessons Learned” – relevance and impact

In 2019 the DfT and IPA jointly commissioned a paper entitled [‘Lessons from transport for the sponsorship of major projects’](#).

The opportunity was taken during this review to test the impact or continuing relevance of that work to Crossrail and to consider the relevance on three other major projects, namely HS2, TRU and LTC.

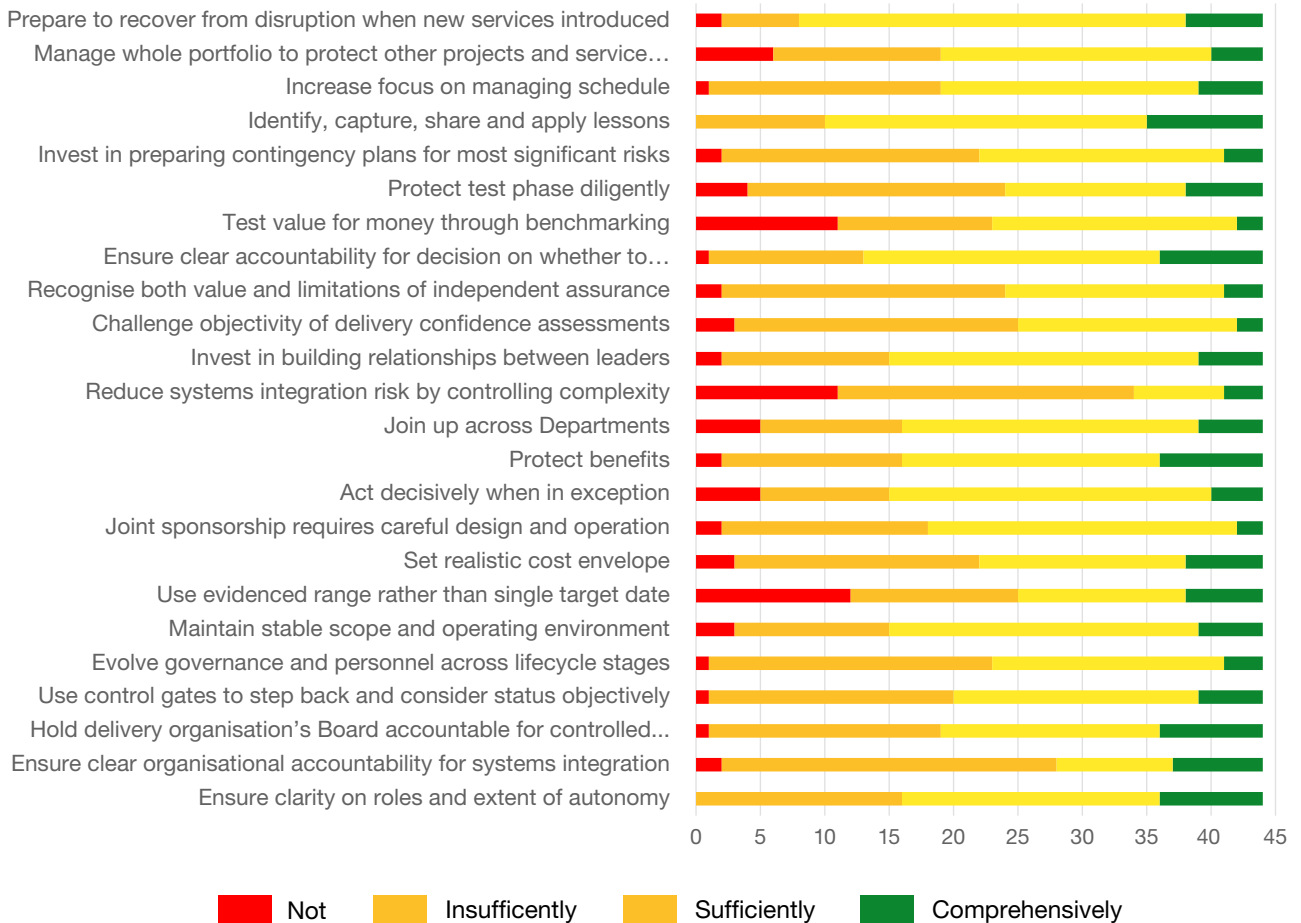
The chart below shows that respondents who had worked on Crossrail regard the 24 Lessons Learned checklist as highly relevant to Crossrail’s situation, with the strongest response relating to systems integration.

**DfT & IPA’s 2019 paper “Lessons from transport for the sponsorship of major projects” had 24 Lessons Learned. Please assess the relevance of those lessons to Crossrail’s situation.**

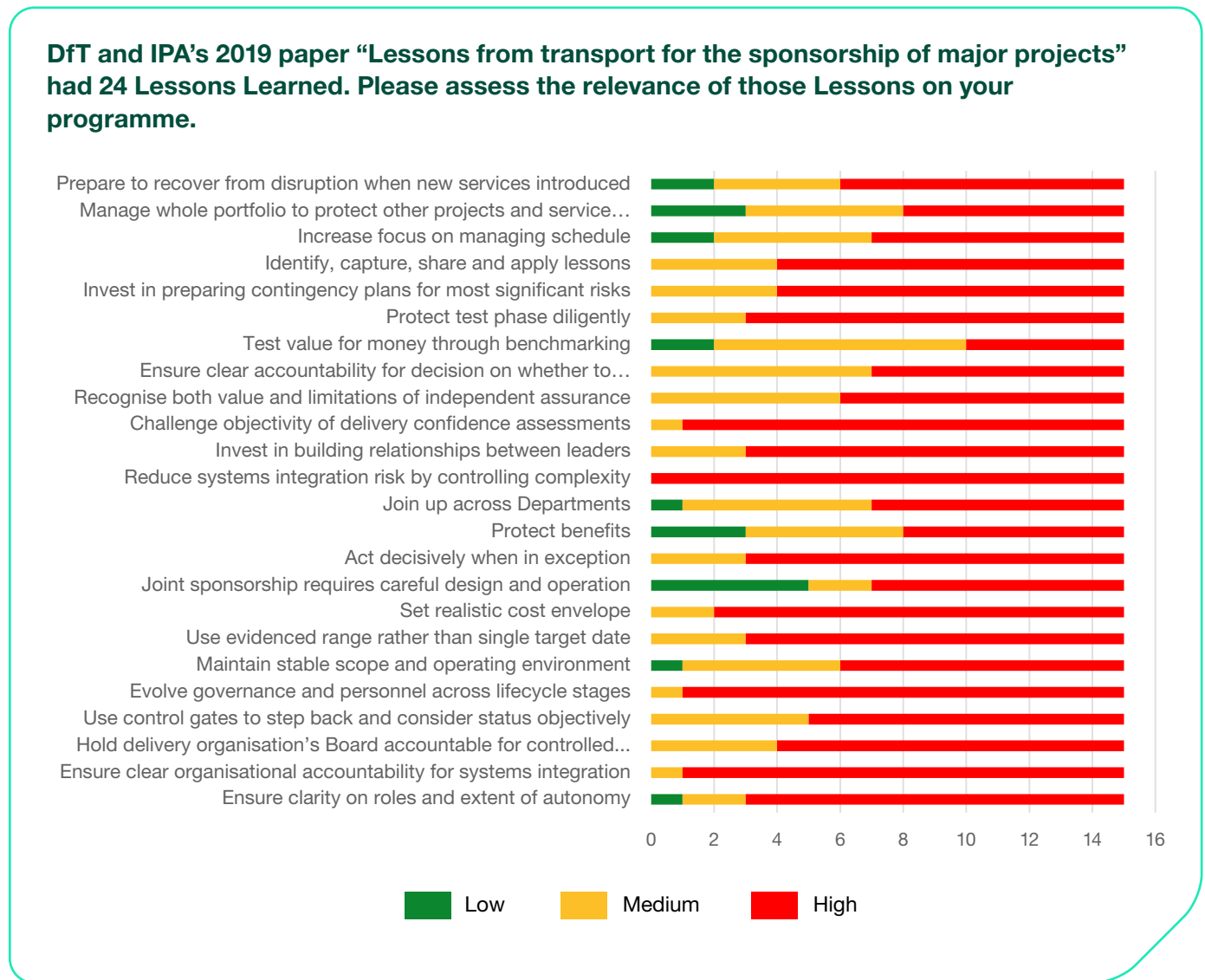


The respondents concluded that Crossrail had not effectively followed the recommendations in the 24 Lessons Learned paper though, as indicated below:

**DfT and IPA’s 2019 paper “Lessons from transport for the sponsorship of major projects” had 24 Lessons Learned. Please indicate the application of these lessons in practice with regards to the Crossrail project.**



Respondents from the other major projects (HS2, LTC and TRU) also felt that the 24 Lessons Learned principles were highly relevant to their projects, as shown below:







## Endnotes

- 1 45 minutes from Heathrow Terminals 2 & 3 to Canary Wharf and 38 minutes to Liverpool Street (according to the TfL Journey Planner for a Wednesday in March 2024 at 10:00, journey times vary based on the time of day)
- 2 <https://www.gov.uk/government/publications/lessons-from-transport-for-the-sponsorship-of-major-projects>
- 3 Note that references to HS2 in this report refer to the programme's scope before the Prime Minister's announcement on 4 October 2023 that Phase 2 would be cancelled and funding redirected towards alternative transport projects across the country
- 4 <https://webarchive.nationalarchives.gov.uk/20100304153342/http://www.dft.gov.uk/pgr/rail/pi/crossrail/fundingandgovernance/sponsorsagreement.pdf>
- 5 <https://webarchive.nationalarchives.gov.uk/20120215025033/http://www2.dft.gov.uk/pgr/rail/pi/crossrail/fundingandgovernance/pda.pdf>
- 6 <https://www.nao.org.uk/reports/crossrail-3>
- 7 An IPA Project Assurance Review typically enables a three- or four-person review team to spend a day planning the review, a day to read selected material and then four or five days to interview stakeholders and prepare a draft report. They are short, sharp snapshots.
- 8 <https://majorprojects.org/wp-content/uploads/2023/06/Highlights-Sponsorship-Final.pdf>
- 9 Source: TfL / Elizabeth line website, <https://tfl.gov.uk/maps/track/elizabeth-line>
- 10 Bombardier were acquired by Alstom in January 2021
- 11 <https://www.eurocontrol.int/publication/revisiting-swiss-cheese-model-accidents>
- 12 Psychological safety is the belief that you won't be punished or humiliated for speaking up with ideas, questions, concerns, or mistakes – The Centre for Creative Leadership <https://www.ccl.org/articles/leading-effectively-articles/what-is-psychological-safety-at-work/>
- 13 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1080239/Handbook\\_-\\_FINAL.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1080239/Handbook_-_FINAL.pdf)
- 14 <https://www.apm.org.uk/resources/what-is-project-management/what-is-sponsorship/>
- 15 <https://learninglegacy.crossrail.co.uk/documents/governance-arrangements-to-complete-the-crossrail-project/>
- 16 As per the HMT 'Green Book' the three stages are a Strategic Outline Case (SOC), an Outline Business Case (OBC) and a Full Business Case (FBC)
- 17 Governance of Co-Owned projects, APM 2017
- 18 For further details refer to TfL Projects and Planning Panel minutes and agenda item 4, 8 May 2013 <https://tfl.gov.uk/corporate/publications-and-reports/projects-and-planning-panel>
- 19 KPMG report on costs and schedule: <https://content.tfl.gov.uk/financial-and-commercial-redacted.pdf>





Department  
for Transport