KPMG

Cost of Capex Delivery

Report for Heathrow Airport Limited

Final Issue

March 2025

Important notice

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Our work commenced on 7 October 2024 and our fieldwork was completed on 03 December 2024. We have not undertaken to update this Report for events or circumstances arising after that date.

Information in this Report is based upon publicly available information and information provided by HAL via interviews and internal reports and reflects prevailing conditions as of the date of the Report, all of which are accordingly subject to change. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. Information sources and source limitations are set out in the Report. We have satisfied ourselves, where possible, that the information presented in this Report is consistent with the information sources used, but we have not sought to establish the reliability or accuracy of the information sources by reference to other evidence. We relied upon and assumed without independent verification, the accuracy and completeness of information available from public and third-party sources. KPMG does not accept any responsibility for the underlying data used in this report.

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KPMG has not assisted HAL in preparation of any aspect of its response(s) to the proposal to which this Report relates. For the avoidance of doubt, it is HAL's sole responsibility to decide what should be included in their response or submission to the CAA. KPMG has not made any decisions for HAL or assumed any responsibility in respect of what HAL decides, or has decided to include in its response or submission.

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

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1.1 Context

The purpose of this report is to support Heathrow Airport Limited (HAL) in its response to the CAA's Method Statement Consultation and HAL's regulatory submissions in H8.

The delivery of large-scale capital projects at Heathrow Airport requires HAL to manage numerous activities that demand complex coordination, substantial resources, and the handling of numerous interconnected risks and opportunities. In addition, airport projects also face additional challenges which are unique to the airport sector. Heathrow Airport has a unique combination of operational environmental and airport sector factors. Heathrow is also located in London/South East of England where construction costs are higher than the UK average.

1.2 Scope of this Report

The primary focus of this report is to assess the extent to which a range of key cost drivers can affect the achievement of cost and efficiency outcomes on large-scale capital projects at Heathrow Airport, considering Heathrow Airport Limited's (HAL's) unique delivery context and including:

- The key factors which drive cost and efficiency for complex capital projects, and the specific factors in the airport sector – see Appendix 1
- The impact of the key factors on the costs of delivery at Heathrow Airport
- How costs are influenced by the geographical location of projects, and the impact of this on Heathrow Airport

1.3 How the Key Factors Were Identified and Assessed

This report identifies the key factors which drive cost and efficiency for complex capital projects through:

- Desktop review of large-scale capital infrastructure projects
- A recent notable National Infrastructure Commission (NIC) report[1] closely related to this topic
- Factors specific to the airport sector, identified through interviews with key HAL personnel and project case studies

The impact of these drivers on the cost of delivering works at Heathrow Airport has been qualitatively evaluated. This report has identified three main sectors of comparison to Heathrow Airport as follows:

1. Other UK airports
2. Rail sector projects
3. General non-regulated construction projects in the UK

These comparison sectors have been selected given that both other UK airports and projects in the rail sector experience comparable constraints as Heathrow Airport in organisational structures and capability, live operational environments, design requirements

[1] Cost drivers of major infrastructure projects in the UK, National Infrastructure Commission 2024

and the impact of regulatory governance. General non-regulated construction projects are used for comparison to show the clear contrast in these factors when compared to Heathrow Airport. In addition, this report has identified the influence of geographical location on construction costs at Heathrow Airport.

1.4 Key Findings and Conclusions

Heathrow Airport does experience cost drivers over and above those typically identified in the construction sector when compared with projects delivered in non-regulated sectors. **Seven factors have been identified as likely key cost drivers**, **with some interaction between them**. Four factors have been identified as likely cost drivers but within an expected range. One factor has been identified as not likely to be a particular cost driver.

The seven likely key cost drivers identified are:

1) **Development and Delivery Capability (client and supply chain):** The need for a substantial development and delivery organisation is a key cost driver and is likely to result in additional costs in excess of the typical range. HAL has a large portfolio of projects which requires increased management costs but also provides a project pipeline and investment certainty to the supply chain. HAL requires an extensive development team and supporting consultants to develop the portfolio; ensuring appropriate capability levels requires time and incurs costs. The scale of the project management organisation at Heathrow Airport is larger than most (not all) regulated sectors and is greater than that required in the airport sector generally due to the large size and complexity of the HAL portfolio.

2) **Governance, Assurance and Decision Making:** Governance processes are a key cost driver and are likely to result in additional costs compared to a typical expected range. The approvals process, number of airlines/stakeholders and their influence adds time to the project development process and cost for HAL. The volume and influence of stakeholders at Heathrow Airport is greater than for most organisations. In comparison to the airport sector generally, stakeholder steering group representation is higher at Heathrow Airport.

3) **Airport Operational Environment:** the airport operational environment presents unique challenges, including security requirements, logistics of working in the Central Terminal Area (CTA) and airside and the need for nighttime working. Whilst some of these factors are experienced elsewhere, the scale and high occupancy rates experienced at Heathrow Airport result in these factors being above the norm, resulting in reduced productivity and increased costs.

4) **Multiple Terminal Operation:** The size of the HAL estate, multiple terminals and large number of ageing assets managed by HAL result in more complex programmes and the need for more works, leading to increased costs. This is also observed in some regulated sectors, but the scale and complexity of Heathrow's operation make this challenge more significant than at other UK airports.

5) **End User and Stakeholder Requirements and Profiles:** Heathrow hosts the largest number of airlines of any UK airport, resulting in a large number of stakeholder interfaces with HAL. The influence of such a large number of airlines results in additional consultation time and layers of governance, can add project scope and increase approvals times, requiring additional management and increasing costs (see 2 also above). This is a common challenge in large infrastructure projects. However, on specific projects and comparably low value

programmes, it is unusual to have a customer (the Airlines) on the project governance board, which is the case at Heathrow Airport.

6) **Regulatory Framework:** The airports regulatory framework at HAL has led to a new DO process with an increased focus on change control, requiring additional HAL resources. This is a challenge specific to the airport industry, and Heathrow Airport status as a major international airport exacerbates this issue.

7) **Location:** The geographical location of Heathrow Airport in London leads to higher construction costs due to regional price differences, location factors, and intense competition for resources within the region. These are exacerbated by the additional costs of construction in the UK driven by regulation and planning law. These factors contribute to the overall cost premium associated with capex delivery at Heathrow

<u>The following four factors are likely cost drivers, but within an expected range:</u>

1) **Organisational Structure and Maturity, inc. Technology and Data Strategy:** This is a cost driver. HAL requires a large organisational structure driven by volume of works, regulatory obligations, stakeholders. The extent of governance and reporting requirements adds time and cost and is greater than that experienced in general non-regulated construction projects. However, this is also seen in regulated sectors.

2) **Commercial Strategy, Contracting Approach and Procurement:** This is broadly not likely to lead to increased costs, with one element potentially adding costs albeit not outside of an expected normal range. At HAL, the use of frameworks and mature supply chain procurement reduces tendering requirements and tender costs compared to typical one-off procurements. However, at HAL the nature of the work and the risk of disruption often requires a flexible contracting approach, e.g. cost reimbursable contracts. This provides flexibility but may be less cost efficient than other contract forms. HAL do however have mature procurement processes which are well known to the supply chain. As a result, pipeline certainty is provided to the supply chain.

3) **Project Management, Cost, Schedule, Benefits and Controls:** This is a cost driver but not outside the normal expected range. The use of a central Programme Management Organisation (PMO) and additional control processes and procedures are an additional cost compared to projects which do not require this level of control. The scale and complexity of the programme HAL manage requires a central PMO, adding cost. The additional change control requirements, as a result of the move to Ex Ante, have also added costs for HAL in contrast with previous delivery periods.

4) **Design, Engineering and Scope Definition:** This is broadly not likely to lead to increased costs, with two elements potentially adding costs albeit not outside of an expected normal range. National airport specific standards and HAL specific requirements result in additional design and construction costs. The influence of airlines in the Delivery Obligations (DO) and design development is unique to HAL and adds time and cost. HAL make use of design framework partners, an approach seen elsewhere. This approach is unlikely to add significant cost. HAL have well developed design resulting from the development of Tranches, use of Early Contractor Involvement (ECI) and robust scoping – this approach is not likely to add cost. Planning and consents can be a cost driver but on a relative basis HAL do not experience this significantly more than other regulated sectors or construction clients for most of the portfolio.

The following factor is not likely to be a cost driver:

1) **Risk and Opportunity Management, inc. Compliance:** This is not likely to be a cost driver. At HAL, risk ownership is defined and well understood. Risk allocation and management appears to be comparatively well balanced in terms of the level of effort mitigating risk and maximising opportunity. Due to the nature of the airport business, HAL has well developed contingency plans.

Conclusion:

Heathrow Airport operates in a unique environment where the airport factors compound to create challenging delivery conditions. HAL requires a large portfolio management organisation to manage multiple programmes of projects. These have to be delivered in constrained operational areas across multiple terminals, influenced by numerous stakeholder requirements, delivered within a regulatory framework, which ultimately results in a complex and challenging delivery environment.

2 Introduction

2.1 Project Objectives

The purpose of this report is to support Heathrow Airport Limited (HAL) in its response to the CAA's Method Statement Consultation and HAL's regulatory submissions in H8.

The delivery of large-scale capital projects at Heathrow Airport requires HAL to manage numerous activities that demand complex coordination, substantial resources, and the handling of numerous interconnected risks and opportunities. In addition, airport projects also face additional challenges which are unique to the airport sector. Heathrow Airport has a unique combination of operational environmental and airport sector factors. Heathrow is also located in London/South East of England where construction costs are higher than the UK average.

This report considers the key cost (and efficiency) drivers of large, complex capital projects at Heathrow Airport, including consideration of the extent to which HAL's geographical location is a cost driver for capital projects.

2.2 Approach

The primary focus of this report is to assess the extent to which a range of key cost drivers can affect the achievement of cost and efficiency outcomes on large-scale capital projects at Heathrow Airport, considering Heathrow Airport Limited's (HAL's) unique delivery context and including:

- The key factors which drive cost and efficiency for complex capital projects, and the specific factors in the airport sector
- The impact of the key factors on the costs of delivery at Heathrow
- How costs are influenced by the geographical location of projects, and the impact of this on Heathrow

2.3 Key Factor Identification

To establish the key factors which drive cost and efficiency experienced by HAL several methods were used. A desk top review of the latest National Infrastructure Commission (NIC) report*: Cost Drivers of major infrastructure projects in the UK* [2], infrastructure case study reviews, focused interviews and HAL-specific case studies were employed to identify the drivers of costs and efficiency and how these materialised in projects. This exercise resulted in the identification of seven key drivers in infrastructure projects and four which were specific to airports.

2.4 Evaluation

Using the identified key factors, an evaluation of the extent to which these are experienced by HAL was undertaken. This qualitatively assessed the impact on the costs of delivery at Heathrow Airport, compared to other UK airports, to rail projects and to general non-regulated general construction projects. Rail projects were looked at specifically as they

[2] Cost drivers of major infrastructure projects in the UK, National Infrastructure Commission 2024

share a number of common features with airport projects including safety, security and operational factors such as short working windows and the need for night working.

2.5 Geographical Location Factor

A desktop study has been undertaken to demonstrate how costs are influenced by the geographical location of projects and to evaluate the location of Heathrow compared to other airports in the UK and Worldwide. The assessment used various indices of regional price differences, location factors and qualitatively assessed cost pressures to demonstrate the way which the geographical location of project impacts costs. Geographical factors have a significant influence on the cost of construction works at Heathrow. Heathrow is part of the London market, which has the highest construction prices in the UK, 21% above the national average and 12% greater than the adjacent South East region. This is also reflected in regional wage differences. London is also the most expensive city in Europe to undertake construction projects. Therefore, construction prices at Heathrow should be expected to be significantly greater than at other UK airports before the physical and operational constraints at Heathrow Airport are taken into account.

3 Key Factors

3.1 Key Factors

3.1.1 Key Factor Identification

At the outset an evaluation framework was proposed which set out the key factors to assess the drivers of cost at Heathrow Airport. Firstly, seven key factors were proposed as drivers of costs in construction projects and programmes. These were:

A. Organisational structure and maturity, inc. technology and data strategy
B. Development and delivery capability (client and supply chain)
C. Governance, assurance and decision making
D. Commercial strategy, contracting approach and procurement
E. Project management, cost, schedule, benefits and controls
F. Design, engineering and scope definition
G. Risk and opportunity management, inc. compliance

In addition, four airport specific key factors were identified. These were:

1) Airport operational environment
2) Multiple terminal operation
3) End user and stakeholder requirements and profiles
4) Regulatory framework and airline governance

To confirm that the proposed key factors influence the cost of capex delivery, a sample of large-scale UK capital delivery infrastructure programmes were assessed. Issues identified in the NIC report[3] were also considered and whether these were applicable at Heathrow. To confirm the key airport specific drivers, Heathrow Airport specific case studies were evaluated, and interviews undertaken with key HAL personnel to validate the presence of the factors experienced.

3.1.2 Case Studies of Infrastructure Projects in the UK

This report presents an analysis of five case studies (see Appendix 2 for details) of large-scale infrastructure investment programmes in the UK, focusing on the key factors that significantly impacted their cost of delivery.

The table in figure 1 below summarises how the key factors were experienced in each case study and whether this factor positively or negatively influenced the project outcome.

[3] Cost drivers of major infrastructure projects in the UK, National Infrastructure Commission 2024

Figure 1: UK Infrastructure key factor comparison

Key:

Factor likely acted as a cost driver = Purple text

Factor likely did not act as a cost driver = Blue text

Item	Category	Crossrail	Thames Tideway	HS2	London 2012 Olympics	Heathrow Terminal 5
Project Description		73 miles with 26 miles of tunnelling, stopping at 41 stations (10 new) and rolling stock	15.5-mile tunnel with 24 shafts and 3 pumping stations	Phase 1: 140-mile new high-speed railway line and 4 new stations	Multiple infrastructure projects, including the Olympic Stadium, Olympic Village, transportation and infrastructure	Terminal building, control tower, car park, hotel and logistics links
Sector		Rail	Water	Rail	Infrastructure	Airports
Value		£18.9bn	£5bn	£58bn-£67bn	£9.3bn	£4.3bn
A	**Organisational Structure and Maturity, inc. Technology and Data Strategy**			Challenge of management effectiveness and strategic planning	Well defined organisation structure, clear roles and responsibilities, experienced leadership	Integrated project team
B	**Development and Delivery Capability (client and supply chain)**	Challenge of expertise in controlling specific complex project elements in an integrated way, varying levels of expertise in supply chain	Strong partnerships with experienced contractors, early-stage planning and risk management, expertise in tunnelling and complex infrastructure delivery.	Challenge of development and delivery capabilities, contractor performance issues, coordination and integration issues	Robust planning and early engagement, highly skilled workforce and contractor network, collaborative approach with stakeholders	Early engagement, shared goals, focus on enhanced productivity and project outcomes
C	**Governance, Assurance and Decision Making**	Challenge of governance not applied effectively / consistently, including robust assurance	Independent oversight by OFWAT and the Environment Agency, independent assurance panel, balanced approach to risk management and decision making, regular audits		Oversight from government bodies and ODA board, transparent decision making, regular reviews and independent assurance mechanisms	Oversight by HAL with independent reviews, empowered contractors, Last Responsible Moment strategy

D	**Commercial Strategy, Contracting Approach and Procurement**	Challenge of efficacy in incentivisation mechanisms	Innovative contract approach, appropriate incentives, aligned outcomes	Challenge of commercial partnerships with developers, contract management and procurement delays		T5 Agreement, Partnering approach, incentive alignment, mature client risk approach
E	**Project Management, Cost, Schedule, Benefits and Controls**	Challenge of performance metrics, shifting timescales		Challenge of realism in assessments of costs and completion dates	Robust PM practices, focus on coordination between contractors and stakeholders, performance-based contracts	Responsible risk approach with appropriate tools and methodologies, Risk pooling, interactive planning cycles
F	**Design, Engineering and Scope Definition**	Evolving project scope caused delays and cost escalations	Collaborative approach, integrated team, advance design for long lead items	Challenge of design changes impacting scope and objectives, design assurance issues		Lean principles, collaborative input from contractors and suppliers,
G	**Risk and Opportunity Management, inc. Compliance**	Challenge of identification of risks	Comprehensive identification, mitigation, and management plans	Challenge of contingency methodologies and application	Extensive risk management framework, proactive risk identification and mitigation, regular audit processes	Retained risk ownership, consistent oversight, risk aggregation

3.2 National Infrastructure Commission Findings

The NIC[4] identified a range of issues that contribute to increased costs and schedule delays in the development of infrastructure projects, which are summarised under the following headings:

- Lack of strategic direction
- Client and Sponsorship challenges
- Inefficient consenting and compliance
- Constrained supply chain

Utilising information obtained from Heathrow focus interviews and case study examination, the table in figure 2 presents whether the issues identified under each heading are applicable to HAL.

[4] Cost drivers of major infrastructure projects in the UK, National Infrastructure Commission 2024

Figure 2: Assessment of Applicability of NIC Findings to HAL

Key:

Applies to HAL = **x**

Does not apply to HAL = ✓

Area	Issue Identified by NIC	Does this apply to HAL?	Comments on HAL
Strategic Direction	Lack of programmatic pipelines and a "rolling work front"	x	There is a strong pipeline with good approach to programming
	Funders, clients and supply chain don't think, learn or evolve across projects	x	Developed and maintained own in-house capability to delivery programmes
	Short term approach to infrastructure funding and delivery	x	Long term approach to delivery via long term frameworks and funding mechanism
	Lack of stable long term investment environment	x	Stable long-term investment via funding mechanism
Client and Sponsorship	Clients not empowered to take decisions	✓	The nature of governance at Heathrow means that the client is not fully empowered to make decisions due to stakeholder influence throughout approvals process
	Underdeveloped project specifications	x	Delivery Obligations set out project specifications early on
	Inappropriate procurement strategy	x	Long term frameworks in place with encouragement of new entrants
	Additional layers of assurance from sponsors	✓	Internal and External assurance carried out
Consenting and Compliance	Uncertainty around how to manage trade-offs	x	Trade-offs are understood with a demonstrable ability to stop projects where required
	Risk aversion drives over-specification of designs	✓	Standards differ from wider UK standards however, there are on-going reviews of this
	Complex systems compound uncertainty	-	Design and consenting environment is well understood by HAL. However, there are a complex set of systems to navigate which do add to uncertainty.
	Misaligned incentives and poorly designed oversight	✓	Incentives are misaligned between CAA, HAL and the supply chain. In simple terms: CAA incentivise HAL through the Regulated Asset Base, but the supply chain are incentivised only via their direct contracts with HAL. The supply chain contracts are not 'back to back' with the HAL obligations and incentive mechanisms but are selected to be appropriate for the nature of the work undertaken.

	Rapidly changing standards	x	Standards are stable and understood
	Unclear standards	x	Standards are clear and documented
	Overly cautious standards	x	Higher standard required for public safety, security and passenger experience across the airport sector
Supply Chain	Risks are too high for the supply chain to invest in capital and skills and for the sector to be able to attract talent	x	Contracts with supply chain are NEC4 Option E and HAL encourage new entrants
	Supply chain becomes fragmented with skills shortages	x	Experienced supply chain with long term relationships, no more at risk than wider UK market
	Poor delivery record and lack of long-term thinking	x	Programme and pipeline of work well understood
	Unstable investment environment with stop-start funding	x	Long term funding mechanism
	Productivity	✓	Airport factors of logistics, security and short working windows
	Fragmentation	✓	Multi-party interfaces and reliance on third party suppliers in some cases
	Skills & Investment	✓	Long term supply chain arrangements however, it takes up to 2 years to onboard a new supplier

Source: Cost Drivers of major infrastructure projects in the UK

From the above high-level assessment, the following item does not appear to apply to projects at Heathrow Airport as a cost driver:

- Strategic direction – The reasoning for this not being a cost driver at Heathrow Airport is because HAL have a strong work pipeline, developed and maintained delivery capabilities, long term delivery approach and a stable long term investment environment.

Based on the assessment, the following areas are likely to be relevant to HAL and should be included in the assessment of key factors:

- Client and sponsorship – Decision making processes and assurance
- Consenting and compliance – Higher specification of designs at Heathrow due to health, safety and security requirements and potentially misaligned incentives
- Supply chain – Productivity constraints and fragmentation

These areas which are likely to be relevant to Heathrow Airport have been mapped, where applicable to the seven key factors and four airport specific factors identified in section 3.1.1 of this report. This mapping has been set out in figure 3 below.

Figure 3: NIC relevant areas mapped to Key Factors:

NIC Area	NIC Issue Identified	Comments	Ref	Key Factor / Airport Specific Factor
Client and Sponsorship	Clients not empowered to take decisions	The nature of governance at Heathrow means that the client is not fully empowered to make decisions due to stakeholder influence throughout approvals process	**C**	**Governance, Assurance and Decision Making**
			3	**End user stakeholder requirements and profiles**
			4	**Aviation regulatory framework and airline governance**
	Additional layers of assurance from sponsors	Internal and External assurance carried out	**C**	**Governance, Assurance and Decision Making**
Consenting and Compliance	Risk aversion drives over-specification of designs	Standards differ from wider UK standards however, there are on-going reviews of this	**3**	**End user and stakeholder requirements and profiles**
	Misaligned incentives and poorly designed oversight	Incentives are misaligned between CAA, HAL and the supply chain	**E**	**Commercial Strategy, Contracting Approach and Procurement**
Supply Chain	Productivity	Airport factors of logistics, security and short working windows	**1**	**Airport Operational Environment**
	Fragmentation	Multi-party interfaces and reliance on third party suppliers in some cases	**B**	**Development and Delivery Capability (client and supply chain)**
	Skills & Investment	Long term supply chain arrangements however, it takes up to 2 years to onboard a new supplier	**B**	**Development and Delivery Capability (client and supply chain)**

3.3 HAL Interview Findings

This report aims to identify the primary cost drivers specific to the airport industry. To achieve this objective, in-depth interviews were conducted with senior members of the HAL team. These interviews served two purposes:

1) To identify the Key Airport Factors experienced by HAL

2) To understand how the general factors manifest in project delivery

The tables provided in figure 4 summarise the key findings from these interviews (see Appendix 3 for more details), which confirmed the validity of the four airport specific factors and four of the key (general) factors.

Figure 4: Interview Findings

Aviation Specific Factor	Key Factor / Airport Specific Factor
Airport operational environment	Heathrow operates at 97% occupancy resulting in work windows being compressed, impacting productivity and increasing costs. This also results in the prevalence of night working experienced.
	High occupancy results in additional costs to minimise disruption to passengers.
	Airside work and the permitting system require more complex control and working arrangements, reducing productivity and increasing cost.
	Managing the impact of construction on airport operations, potential permit delays, and the impact of late flights can increase project costs due to the need for contingency plans and additional resources.
Multiple terminal operation	The limited laydown areas and single access road to central terminal area (CTA) can constrain access and lead to complexity and increased costs due to the need for careful planning and coordination of deliveries and work activities.
	Distributed welfare is required due to the spread-out nature of work can increase project costs due to the need for additional facilities and resources.
	Asset base of 500,000+ assets with activity almost unprecedented outside of significant single terminal upgrades.
End user and stakeholder requirements and profiles	The lengthy approval process from problem statement to investment decision and project delivery can lead to increased costs due to delays and the need for additional resources.
	Governance process includes two internal steering groups and two external with airline presence at one of these potentially leading to increased mitigations and slower project progression.
End user and stakeholder requirements and profiles	Change from Ex Post to Ex Ante has required the introduction of DOs and results in an increased focus on managing change contributing to higher project management costs.
	The change from Ex Post to Ex Ante has changed the budget setting from being based on deterministic (base schedule/cost) to a risk inclusive estimate (Deterministic plus P50 Risk Allowance (or for key projects P80)) for both schedule and cost, which has led to higher initial cost estimates than under Ex Ante than Ex Post, as they now include quantified risk allowances.
	Utilising ECI contracts to gain early access and mitigate changes can increase upfront costs but provides greater scope clarity and any potential mitigation requirements.
	The involvement of multiple airlines in the DO approval process can add time and cost to the process when compared with other sectors. This is mitigated when approvals are not escalated by HAL.

Key Factor	Key Factor / Airport Specific Factor
Development and Delivery Capability (client and supply chain)	The time required for new contractors to become efficient leads to increased costs and schedule inefficiency.
	Challenges with fuel and steelwork availability can lead to project delays and increased costs due to material shortages and price fluctuations.
	Managing dependencies on external parties like NATS and UKPN can lead to project delays and increased costs if these parties experience disruptions or delays.
Governance, Assurance and Decision Making	The governance process can be lengthy for large projects with multiple airlines. Retrospective governance for minor works is used to avoid disproportionately time-consuming governance processes for small projects.
Commercial Strategy, Contracting Approach and Procurement	Fixed price contracts for equipment and Option C or E for construction (usually Option E over £1M),
	The tiered framework approach and the long onboarding time for new suppliers can impact project costs due to the need for established relationships and familiarity with Heathrow's environment.
	Intense competition for resources in the London/SE region results in a cost premium.
Design, Engineering and Scope Definition	Occasional delays due to planning issues and protests can disrupt project schedules and increase costs however, these are rare.

3.4 HAL Project Case Studies

This report presents an analysis of three case studies of projects delivered at Heathrow Airport, focusing on the factors that impact their cost of capex delivery. These case studies show that cost of delivery was influenced by the four airport factors proposed. The table in figure 5 summarises how the presence of these factors influenced the case study projects (see Appendix 2 for more details):

Figure 5: HAL Project Case Study Summary

		HAL Project		
Factor	Sub-Factor	RHS Baggage System	Rail OTN & PLC	Airfield Pavement Rolling Lifecycle
Airport operational environment	**Security requirements**	Security screening, permits	Security screening, permits	Security screening, permits
	Logistics of working in CTA and airside	Working area, material issues, logistics. productivity, embargo days, live baggage environment, circa £10m mitigations	Access to the tunnel to carry out works via limited number of access shafts withing the CTA	Operational area impacted, productivity, batching equipment
	Need for night working	Daytime limitations, night working	Night working	Daytime limitations, night working
Multiple terminal operation	**Multiple terminals, large number of assets, Asset age**	Asset age, volume of assets, live working environment, continuous renewal	Asset age, volume of assets, live working environment, continuous renewal	Asset age, volume of assets, operational areas, asset criticality factors, material selection, continuous renewal
	Connections to public transport, Road access	N/A	N/A	N/A
End user and stakeholder requirements and profiles	**Passenger, airline, ground handling, retail, etc requirements**	passenger/airline/handling considerations, specialist steering group, baggage mitigations	Live rail network, return to operations, passenger considerations	No known direct impact
	Completion deadlines, Stakeholder milestones/deadlines	Long approvals process	Long approvals process	Rolling programme benefits
	Industry standards, user technical requirements	Complex integrations, specialist technical suppliers	Replacement to latest standards	Standard designs and specifications
Aviation regulatory framework and airline governance	**Regulatory obligations**	Overhead and risk costs, approval timescales, mitigations	Overhead and risk costs, ECI, approval timescales	Overhead and risk costs

3.5 Key Factors Conclusion

This report has identified key factors that influence the cost of capital delivery in the airport industry. Through a combination of desktop study, case studies of large-scale infrastructure projects in the UK, HAL project case studies and interviews with senior members of the HAL team, it has been identified that seven general key factors and four airport-specific key factors have a demonstrable impact on project costs. All factors identified drive project cost, with the HAL interviews and case studies bringing to life the impact of these drivers.

HAL operates in a unique programmatic environment where all interventions are impacted by operational challenges. The multiple terminal operation exacerbates the operational challenges due to the volume of assets and level of activity required on the site. This is compounded by long governance routes and stakeholder requirements meaning that interventions are not only complex and challenging to deliver efficiently but the programme management requirements also must manage various levels of complexity.

4 Evaluation

4.1 Comparison with Other Sectors

To assess the applicability and impact of the identified factors experienced by HAL, a qualitative analysis has been conducted using experience and SME judgement to contrast observations identified through HAL interviews and project case studies. This has enabled a comparison to other UK airports, the UK rail sector and the general non-regulated construction sector in the UK.

The analysis has focused on determining whether the factors apply to HAL and the other sectors, plus whether the impact of these factors is greater or lesser than for HAL compared to other airports or sectors. The rail sector was specifically chosen for comparison due to its similarities as a regulated transport sector. Figure 6 below details this evaluation.

Figure 6: Evaluation of the impact of Key Factors on HAL, UK airports, UK rail and UK general non-regulated construction projects

Key:

** = Identified as a driver in the NIC report 0 = Factor is not likely to result in additional costs

1 = Factor is likely to result in additional costs 2 = Factor is likely to result in additional costs in excess of an expected normal range

Ref	Factor	Sub-factor	Seen in Heathrow Case Study	Observations	Does factor lead to increased cost?			
					HAL	Air	Rail	Gen
A	Organisational Structure and Maturity, inc. Technology and Data Strategy	Client organisation	Interviews	Large complex organisational structure due to volume of works, regulatory obligations and multiple stakeholders increases indirect costs. These are seen by HAL and other regulated infrastructure organisations but not general non-regulated projects	1	1	1	0
		Business Case development and approval	1 and 2	Extent of governance at regulated infrastructure organisation, including HAL, is greater in comparison to general non-regulated projects, adding time and cost	1	1	1	0
		Reporting	1, 2, 3	There are extensive reporting requirements seen by HAL as a result of various steering groups etc., in excess of what is seen in general non-regulated projects. This is also seen in other airports and railways.	1	1	1	0
		Scoring			**3**	**3**	**3**	**0**
B	Development and Delivery Capability (client and supply chain)**	Portfolio approach, pipeline etc.**	1,2,3	HAL has a large portfolio of complex projects due to its large asset base, similar to the rail sector. This is seen at other UK airports but not on the same scale. The large portfolio leads to the need for full time PMO, increasing overall programme management costs compared to typical smaller projects. However, the large portfolio means the PMO can operate efficiently and has the benefit of offering a good continuous workflow for delivery partners, which must mitigate the additional costs to some extent. This certainty of a pipeline of work also facilitates supply chain investment.	1	1	1	0
		Development team, consultants, partners etc	1,2,3	HAL requires an extensive development team and consultants, which requires to be aligned to commercial and delivery strategy. Developing and maintaining capability levels take time and adds cost. HAL and the rail sector have the greatest requirement due to their size.	2	1	2	0
		PM organisation, designers, delivery frameworks, specialist suppliers	1,3	The PM organisation has similar challenges to the development organisation and has to deal with multiple complex, high volume projects. The scale and complexity of work at HAL means more management is required and the costs are greater than typically seen. The rail sector has similar challenges.	2	1	2	0
		Scoring			**5**	**3**	**5**	**0**

Ref	Factor	Sub-factor	Seen in Heathrow Case Study	Observations	Does factor lead to increased cost?			
					HAL	Air	Rail	Gen
C	Governance, Assurance and Decision Making**	Approval processes	1,2	The approvals process at HAL adds significant time to projects with 2 internal and 2 external approval groups and is more akin to major one off projects such as RAPID. The rail sector also has lengthy multistage approval processes, whereas general non-regulated projects are less complex	2	1	2	0
		Multiple Assurers**	Interviews	HAL requires more internal and external assurance than typical projects, as do other regulated industries	1	1	1	0
		No of stakeholders and influence of stakeholders	1	Heathrow has 4 steering groups at each gateway, 2 internal and 2 external with multiple stakeholders represented at each. The number of stakeholders is greater than for most organisations	2	1	1	0
		Scoring			**5**	**3**	**4**	**0**
D	Financing and Funding Arrangements	NOT USED						
E	Commercial Strategy, Contracting Approach and Procurement **	Use of frameworks etc.	1,2,3	The use of frameworks and mature supply chain procurement reduces tendering requirements and tender costs compared to typical one-off procurements. In addition provides pipeline certainty to supply chain.	0	0	0	1
		Contract types (Cost plus/target cost/etc), risk allocation and incentives**	1,2,3	At HAL, the nature of the work and the risk of disruption often requires a flexible contracting approach, such as the use of re-measurable contracts and prevents greater use of fixed price contracts. HAL make wide use of NEC4 Option E contract, managed by a team with good contract knowledge and management. While this approach is sensible given the level of disruption encountered on a day-to-day basis, it reduces the opportunity to use competition to optimises prices. Similar challenges are faced at other airports and the rail sector, whereas in general non-regulated projects, competition is more widely used to optimise prices	1	1	1	0
		Procurement process etc	1,2,3	HAL have mature procurement processes which are well known to the supply chain, as do other airports and the rail sector, which should help to reduce bidding costs. General non-regulated projects are likely to be more transactional.	0	0	0	Varies
		Scoring			**1**	**1**	**1**	**1**
F	Project Management, Cost, Schedule, Benefits and Controls	Established processes and procedures	1,2,3	Additional project management control processes and procedures required by HAL due to the scale of the portfolio, as seen at other organisations with a large asset base, which add cost	1	1	1	0
		Change Control	Interviews	HAL have had to introduce additional change control processes as a result of the Ex-Ante regime, which has added costs compared to the previous regime	1	N/A	N/A	N/A
		Use of central PMO	Interviews	The scale and complexity of the programme HAL manage requires a central PMO, adding cost compared to smaller projects. PMOs are seen in other organisations managing portfolios and programmes or work	1	1	1	0
		Scoring			**3**	**2**	**2**	**0**

Ref	Factor	Sub-factor	Seen in Heathrow Case Study	Observations	Does factor lead to increased cost?			
					HAL	Air	Rail	Gen
G	Design, Engineering and Scope Definition	Design requirements	1,2,3	The need for national airport specific standards and HAL specific requirements increases design and construction costs compared to non-regulated general projects. Additional requirements also exist in other transport infrastructure	1	1	1	0
		Design delivery	1,2,3	HAL make use of design framework partners, an approach seen elsewhere. This approach is unlikely to add significant cost compared to other sectors	0	0	0	0
		Under-developed design	1,2,3	Poorly defined initial requirements and scope can lead to cost increases. While this issue is seen across a wide variety of projects, HAL's use of development of Tranches, ECI and scoping leads to well-developed design.	0	varies	varies	1
		Approvals	Interviews	The involvement and influence of the airlines in the DO and design development and sign off can add time and cost, especially if a project is in escalation.	1	0	0	0
		Process for defining and agreeing scope	1,2,3	Development of Tranches, ECI and scoping leads to well-developed design. This is likely to be better developed then on general non-regulated projects.	0	0	0	1
		Planning and Environment	Interviews	Planning and consents can cause delays and scope change. However, HAL does not appear to suffer more cost impacts than other organisations	0	0	0	0
		Objectors and protesters	Interviews	At HAL, occasional delays due to planning objections and protests can disrupt project schedules and increase costs. However, these are rare and do not appear to be worse than for other airports or major projects.	0	0	0	0
		Scoring			**2**	**1**	**1**	**2**
H	Risk and Opportunity Management, inc. Compliance	Key risk allocation and management	1,2,3	At HAL, risk ownership is defined and well understood. Risk allocation and management does not appear to be more onerous than at other airports or major projects.	0	0	0	0
		Contingency plans	1,2,3	Due to the nature of the airport business, HAL has well developed contingency plans, as do other infrastructure owners. One off projects are more likely to have to invest in developing new contingency plans	0	0	0	1
		Scoring			**0**	**0**	**0**	**1**
1	Airport operational environment**	Security requirements	1,2,3	Airports have additional security requirements which affects the management of projects, including the need for security passes, which adds to costs.	1	1	0	0
		Logistics of working in CTA and airside	1,2,3	The size and scale of HAL and the limited access points to the CTA increase the time taken to go to and from the worksite, which reduces productivity	2	1	1	0
			1,2,3	Airport operational security requirements mean all staff, materials and equipment must be screened before being used airside. This adds time and cost to airside works. Individuals without a pass must be escorted, adding additional cost.	1	1	0	0
			1	CTA road access is restricted by the tunnels which are often subject to delays, which can disrupt work	1	0	0	0
			Interviews	Workforce often has to assemble off site and be moved by bus due to the size of the site and security controls, adding time and cost.	1	0	0	0

Ref	Factor	Sub-factor	Seen in Heathrow Case Study	Observations	Does factor lead to increased cost?			
					HAL	Air	Rail	Gen
		Need for nighttime working	1,3	At airports, the limited time window between last flight and first flight the next morning for night working reduces productivity and exacerbates the premium of nighttime working, particularly when flights are delayed. As the busiest airport, HAL is most exposed to this problem. This is also seen when working on railways	2	1	2	0
		Scoring			**8**	**4**	**3**	**0**
2	Multiple terminal operation**	Multiple terminals, large number of assets, asset age	1,2,3	A combination of multiple terminals and a large number of aging assets results in more complex programmes and the need for more works. This is also seen on railways.	1	0	1	0
		Connections to public transport, road access	Interviews	HAL is well connected by surface rail, underground, buses and major roads. Railways often require work in remote locations with limited access, increasing cost	0	0	1	varies
		Scoring			**1**	**0**	**2**	**0**
3	End user and stakeholder requirements and profiles**	Passenger, airline, ground handling, retail, etc requirements	1	The very large number of stakeholders at HAL and their influence results in additional layers of governance	1	0	0	0
		Completion deadlines, stakeholder milestones/deadlines	Interviews	The Ex-Ante regime penalises late delivery, resulting in the need for more mature proposals at approval stage, requiring additional development time and including more risk allowed for at the outset compared to the previous Ex Post arrangements	1	N/A	N/A	N/A
		Industry standards, User technical requirements	1,3	Airport and HAL specific standards, such as enhanced levels of fire safety, security etc, add to project costs compared to typical projects. Rail projects also have additional standards	1	1	1	-
		Scoring			**3**	**1**	**1**	**0**
4	Aviation regulatory framework	Regulatory obligations	Interviews	HAL has an increased focus on change control following change from Ex Post to Ex Ante and the introduction of DOs, requiring additional resources	1	N/A	N/A	N/A
			Interviews	The change from Ex Post to Ex Ante has changed the budget setting from being based on deterministic to a risk inclusive estimate (Deterministic plus P50 Risk Allowance (or fr kep projects P80) for both schedule and cost, which has led to higher initial cost estimates than under Ex Ante than Ex Post, as they now include quantified risk allowances.	1	N/A	N/A	N/A
			Interviews	The lengthy approval process from problem statement to investment decision to project delivery has led to increased costs at HAL	1	N/A	N/A	N/A
			2	Utilising ECI contracts to gain early access and mitigate changes can increase upfront costs but potentially reduce overall project costs by minimising rework and delays.	0	0	0	0
			Interviews	The involvement of multiple airlines in the DO approval process can add time and cost to the process, especially when a project is in escalation. HAL has a large number of airlines	2	1	0	0
		Scoring			**5**	**1**	**0**	**0**
		Total Scoring			**54**	**28**	**32**	**8**

The assessment presented above has used observations from case studies and interviews with HAL personnel, in addition to cross sector experience, to provide a qualitative evaluation of the key factors which drive cost and efficiency for complex capital projects, and the specific factors in the airport sector. This evaluation has aimed to determine whether the factors apply more at HAL then elsewhere and, hence, contribute to additional costs compared to the norm and has provided supporting observations to substantiate the HAL position.

4.2 Key Findings

4.2.1 General Factors

1) **Organisational Structure and Maturity, inc. Technology and Data Strategy:** This is a cost driver. HAL requires a large organisational structure driven by volume of works, regulatory obligations, stakeholders. The extent of governance and reporting requirements adds time and cost and is greater than that experienced in general non-regulated construction projects. However, this is also seen in regulated sectors.

2) **Development and Delivery Capability (client and supply chain):** The need for a substantial development and delivery organisation is a key cost driver and is likely to result in additional costs in excess of the typical range. HAL has a large portfolio of projects which requires increased management costs but also provides a project pipeline and investment certainty to the supply chain. HAL requires an extensive development team and supporting consultants to develop the portfolio; ensuring appropriate capability levels requires time and incurs costs. The scale of the project management organisation by total headcount at Heathrow Airport is larger than most (not all) regulated sectors and is greater than that required in the airport sector generally due to the large size and complexity of the HAL portfolio.

3) **Governance, Assurance and Decision Making:** Governance processes are a key cost driver and are likely to result in additional costs compared to a typical expected range. The approvals process, number of airlines/stakeholders and their influence adds time to the project development process and cost for HAL. The volume and influence of stakeholders at Heathrow Airport is greater than for most organisations. In comparison to the airport sector generally, stakeholder steering group representation is higher at Heathrow Airport.

4) **Commercial Strategy, Contracting Approach and Procurement:** This is broadly not likely to lead to increased costs, with one element potentially adding costs albeit not outside of an expected normal range. At HAL, the use of frameworks and mature supply chain procurement reduces tendering requirements and tender costs compared to typical one-off procurements. However, at HAL the nature of the work and the risk of disruption often requires a flexible contracting approach, e.g. cost reimbursable contracts. This provides flexibility but may be less cost efficient than other contract forms. HAL do however have mature procurement processes which are well known to the supply chain. As a result, pipeline certainty is provided to the supply chain.

5) **Project Management, Cost, Schedule, Benefits and Controls:** This is a cost driver but not outside the normal expected range. The use of a central Programme Management Organisation (PMO) and additional control processes and procedures are an additional cost compared to projects which do not require this level of control. The scale and complexity of the programme HAL manage requires a central PMO,

adding cost. The additional change control requirements, as a result of the move to Ex Ante, have also added costs for HAL in contrast with previous delivery periods.

6) **Design, Engineering and Scope Definition:** This is broadly not likely to lead to increased costs, with two elements potentially adding costs albeit not outside of an expected normal range. National airport specific standards and HAL specific requirements result in additional design and construction costs. The influence of airlines in the Delivery Obligations (DO) and design development is unique to HAL and adds time and cost. HAL make use of design framework partners, an approach seen elsewhere. This approach is unlikely to add significant cost. HAL have well developed design resulting from the development of Tranches, use of Early Contractor Involvement (ECI) and robust scoping – this approach s not likely to add cost. Planning and consents can be a cost driver but on a relative basis HAL do not experience this significantly more than other regulated sectors or construction clients for most of the portfolio.

7) **Risk and Opportunity Management, inc. Compliance:** This is not likely to be a cost driver. At HAL, risk ownership is defined and well understood. Risk allocation and management appears to be comparatively well balanced in terms of the level of effort mitigating risk and maximising opportunity. Due to the nature of the airport business, HAL has well developed contingency plans.

4.2.2 Airport specific factors

8) **Airport Operational Environment:** The airport operational environment presents unique challenges, including security requirements, logistics of working in the Central Terminal Area (CTA) and airside and the need for nighttime working. Whilst some of these factors are experienced elsewhere, the scale and high occupancy rates experienced at Heathrow Airport result in these factors being above the norm resulting in reduced productivity and increased costs.

9) **Multiple Terminal Operation:** The size of the HAL estate, multiple terminals and large number of ageing assets managed by HAL result in more complex programmes and the need for more works, leading to increased costs. This is also observed in some regulated sectors, but the scale and complexity of Heathrow's operation make this challenge more significant than at other UK airports.

10) **End User and Stakeholder Requirements and Profiles:** Heathrow hosts the largest number of airlines of any UK airport, resulting in a large number of stakeholder interfaces with HAL. The influence of such a large number of airlines results in additional consultation time and layers of governance, can add project scope and increase approvals times, requiring additional management and increasing costs. This is a common challenge in large infrastructure projects. However, on specific projects and comparably low value programmes, it is unusual to have a customer (the Airlines) on the project governance board, which is the case at Heathrow Airport.

11) **Regulatory Framework :** The airports regulatory framework at HAL has led to a new DO process with an increased focus on change control, requiring additional resources. This is a challenge specific to the airport industry, and Heathrow Airport status as a major international airport exacerbates this issue.

5 Geographical Location Factors

5.1 Geographical Factors

There are differences in construction prices between the UK regions where large airports are located and also particular additional cost pressures within London and the South East, which affects the cost of projects at Heathrow Airport.

5.2 Regional Price Differences.

The impact of geographical location of costs is illustrated by the range of locations of the ten largest airports in the UK by passenger numbers, which are widely spread across the country in different economic regions. This is set out in figure 7.

Figure 7: Top Ten Busiest Airports in the Great Britain* in 2023

Rank	Airport	Annual Passengers (million)	Aircraft Movements (thousand)	Number of Airlines	Number of Runways	Location (UK Region)
1	**Heathrow**	**79.1**	**457**	**89**	**2**	**London**
2	Gatwick	40.9	257	56	1	South East
3	Manchester	28.1	180	49	2	North West
4	Stansted	28.0	195	17	1	East of England
5	Luton	16.4	128	11	1	East of England
6	Edinburgh	14.4	115	35	2	Scotland
7	Birmingham	11.5	87	30	1	West Midlands
8	Bristol	9.9	77	26	1	South West
9	Glasgow	7.3	75	26	1	Scotland
10	Newcastle	4.8	45	17	1	North East

Source: CAA

**Excludes Northern Ireland*

The differences in construction costs seen in the different regions where the top ten airports are located can be seen in standardised cost and price information published by the Building Cost Information Service (BCIS), which maintains a database of cost, price and inflation data for the UK construction industry and publishes a wide range of indices. The following indices show the differences in construction cost between regions:

- **Regional Tender Price Indices** (RTPI): A tender price index (TPI) based on actual data supplied by the construction industry use to track the change in average prices through time. The RTPI provides a separate index for each region of the country.
- **Location Factor** (LF): a factor used to adjust average UK prices to a particular region. The factor for national average prices is always set at 100.

5.3 Regional Tender Price Indices

The RTPI allows differences in the rate of price changes between regions to be seen. The RTPI for all regions were set to 100 in 2010. The current RTPI values for each region are shown in the figure 8 below.

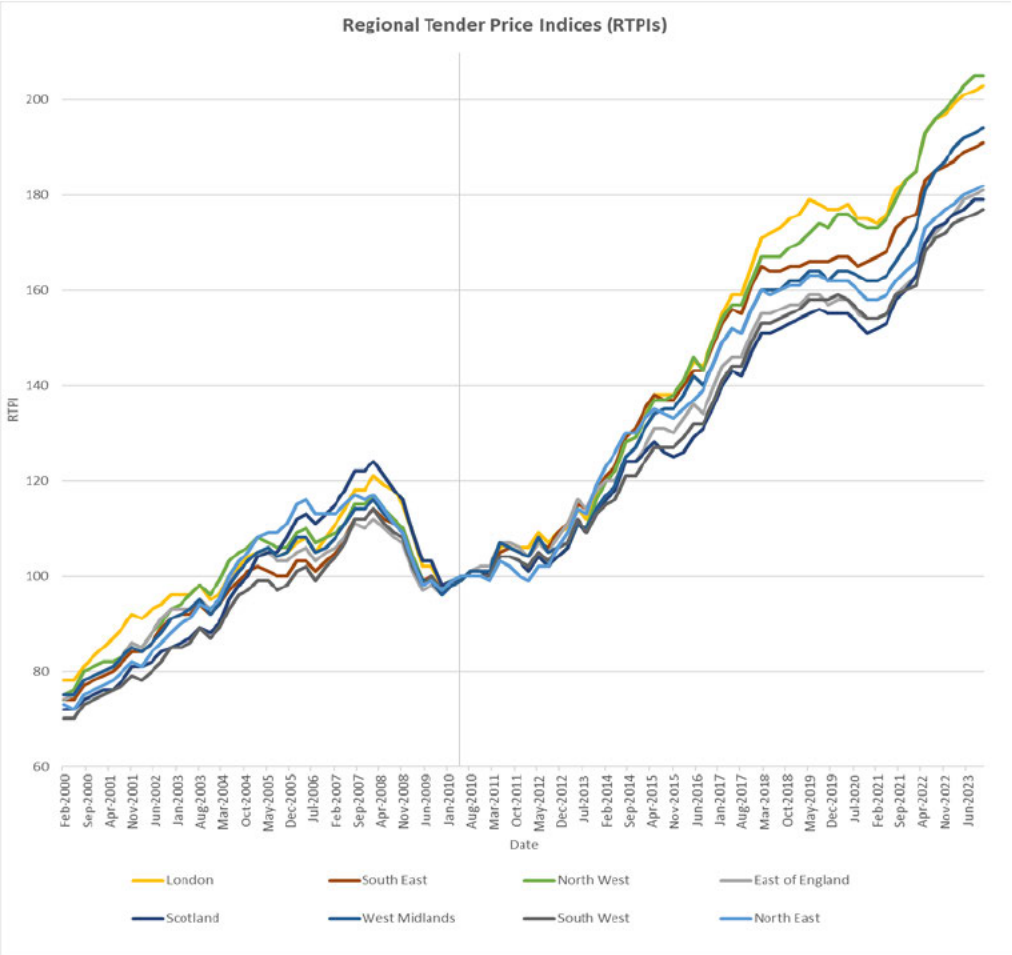
Figure 8: RTPI Values

Rank	Airport	Location (UK Region)	RTPI Sep 2024
1	**Heathrow**	**London**	**203**
2	Gatwick	South East	181
3	Manchester	North West	205
4	Stansted	East of England	181
5	Luton	East of England	181
6	Edinburgh	Scotland	179
7	Birmingham	West Midlands	194
8	Bristol	South West	177
9	Glasgow	Scotland	179
10	Newcastle	North East	182

Source: BCIS

Since 2010, the national All-in TPI has increased from 218 to 394. To make this UK average value comparable to the regional RTPI value we must rebase the value to 100 in 2010, which gives an equivalent national RTPI value of 181. The London, North West, West Midlands regions have all seen significantly greater than average price increases since 2010. London has seen the second largest increase (203) with an increase 13% above the national average. The London Region has also consistently seen above average increases in construction prices since 2000. The RTPI values since 2000 are plotted in figure 9 (see Appendix 4 for details).

Figure 9: Comparison of RTPI values since 2000



Source: BCIS

The RTPI illustrates the rate of price increase within each region but does not show the full differences between regions as the baseline prices for each region are different. The differences between regions are shown by the Location Factor (LF).

5.4 Location Factors

Each Quarter the LF is calculated for each UK region, based on actual price data, allowing differences in prices between regions to be estimated and allowing national average prices to be adjusted to reflect market conditions in each region. An LF above 100 indicates that prices are above the national average and a value below 100 that prices are below average. The LF reflects the difference in regional costs at the time they are published. The latest LF values are shown in figure 10 below.

Figure 10: LF Values

Rank	Airport	Location (UK Region)	RTPI Sep 2024
1	**Heathrow**	**London**	**121**
2	Gatwick	South East	108
3	Manchester	North West	100

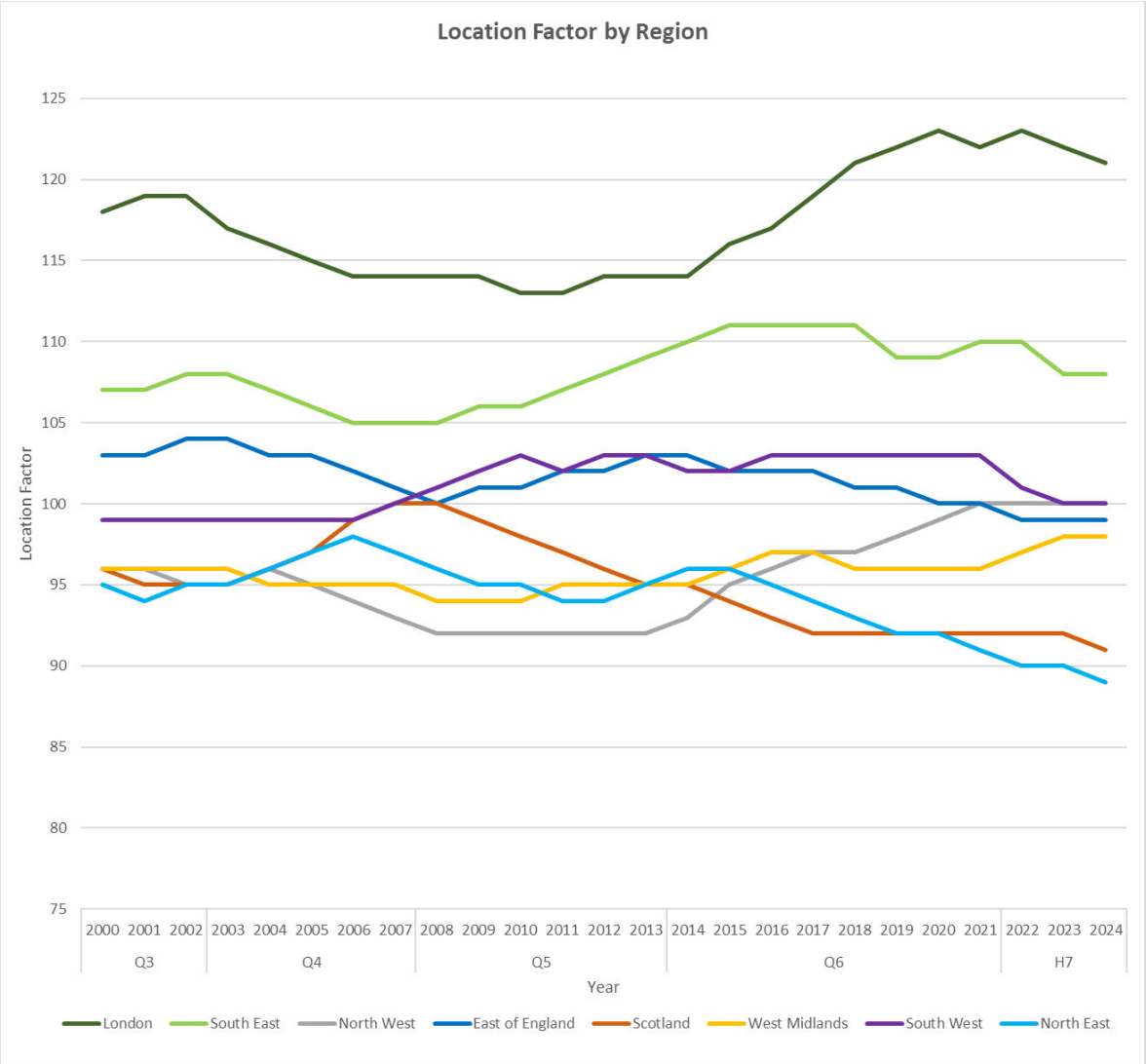
4	Stansted	East of England	99
5	Luton	East of England	99
6	Edinburgh	Scotland	91
7	Birmingham	West Midlands	98
8	Bristol	South West	100
9	Glasgow	Scotland	91
10	Newcastle	North East	89

Source: BCIS

The London region has a location factor of 121 (21% above the national average), by far the highest prices of any region containing a top ten airport, and 12% above the next highest region, South East, which is the next closest to Heathrow. This is consistent with the RTPI data, which indicates that London has consistently been amongst the regions with the highest rate of price increases, which would lead to the highest relative regional prices.

A plot of the change in LF values since 2000 shows how the relative pricing between regions has changed over time (see figure 11 below and Appendix 4 for details). London has consistently been the highest cost region, with the South East seeing the second highest prices.

Figure 11: Regional Location Factor Since 2000



Source: BCIS

5.5 Regional Wage Differences

To test to what extent differences in wages could be responsible for the differences in construction costs between regions, regional median gross annual pay rates can be compared between regions. The Office for National Statistics (ONS) maintains a survey of earnings and hours worked, by region, by occupation, including three categories relevant to the construction industry:

- 53: Skilled metal, electrical and electronic trades
- 54: Skilled construction and building trades
- 55: Science, research, engineering and technology professionals

The results for 2023 (the most recent complete year) are summarised in the figure 12.

Figure 12: Median Gross Annual Pay (2023) for Jobs in the Construction Sector and a Comparison to National Median Values

	Skilled metal, electrical and electronic trades		Skilled construction and building trades		Science, research, engineering and technology professionals	
Region	**Median (£)**	**vs UK Median**	**Median (£)**	**vs UK Median**	**Median (£)**	**vs UK Median**
UK	**34,462**	**0%**	**31,934**	**0%**	**45,793**	**0%**
North East	32,219	-7%	29,701	-7%	41,992	-8%
North West	33,327	-3%	31,326	-2%	43,190	-6%
Yorkshire and The Humber	34,417	0%	30,112	-6%	41,675	-9%
East Midlands	33,751	-2%	31,863	0%	43,186	-6%
West Midlands	32,799	-5%	31,248	-2%	44,615	-3%
East	35,431	3%	32,444	2%	47,626	4%
London	**37,733**	**9%**	**35,952**	**13%**	**53,290**	**16%**
South East	35,502	3%	34,296	7%	47,517	4%
South West	33,213	-4%	32,776	3%	43,663	-5%
Wales	34,536	0%	31,953	0%	41,155	-10%
Scotland	36,530	6%	31,790	0%	43,461	-5%

Source: ONS – Work Region Occupation SOC20 Table 3.7a

It should be noted that the quality of the data varies across the regions and includes a margin of error but the values for all regions are considered to be acceptable by the ONS.

The data shows that in London, in all three categories, the median gross annual pay is greater than the UK median value for; skilled metal, electrical and electronic trades by 9%; skilled construction and building trades by 13%; and Science, research, engineering and technology professionals by 16%. The values for London are also significantly greater than in the regions closest to London, the East and South East. This is consistent with seeing higher construction costs in London indicated by the Location Factor, although the differences are less pronounced in the trades. This indicates that there are additional market factors affecting the costs in London, such as completion for other resources such as plant materials, equipment and land, and the cost of doing business in London.

5.6 Cost Pressures within London and South East

A qualitative assessment of the positive and negative aspects of the location of Heathrow Airport is summarised in figure 13.

Figure 13: Cost Pressures within London and South East Qualitative Assessment

Factor	Positive	Negative
Accessibility	Heathrow is well connected by Mainline Rail, Underground, Motorway and Local Road network	Limited Parking Expensive accommodation for those travelling from outside the region
Labour Availability	Access to a large pool of labour based in the London and the South East 17% of all UK construction firms are located London and the South East.	Competition from strong London market, including large projects such as HS2 and major London Underground schemes
Labour Costs	-	Higher rates of pay in London and South East compared to the rest of the country
Local Market	London and the South East make up a significant proportion of the UK construction market	More competition from other projects Competition from big projects/organisations e.g. HS2, London Underground
Major Projects	Long term work availability/commitments for contractors and workforce	Larger schemes compete for resources with large projects outside the region, such as Hinkley Point C (and Sizewell C when it starts), NHP

Overall, Heathrow is well connected and has access to a pool of skilled construction resources. However, the London market is large and usually includes some major construction programmes, such as London Underground, Crossrail or HS2, which increase the competition for resources. While the long-term nature of work at Heathrow is attractive to contractors and consultants, there is usually plenty of competition for resources from the London market which is likely to contribute to higher prices.

5.7 International Comparison

The engineering and built asset consultancy Arcadis publishes an annual report on the costs of construction work around the world. The most recent report, Report International Construction Costs 2024, provides an International Construction Cost (ICC) index value for 100 cities around the world based on benchmark cost data. It can be used to compare costs for complete buildings across different geographies. The ICC is sensitive to factors such as currency fluctuations, differences in specification, site constraints and location specific requirements, which should be taken into account when making direct comparisons, but it does provide a high-level comparison. It is only applicable to the cost of a building shell and basic services installation and does not cover complex installations such as data centres. The index indicates the relative cost compared to costs in Amsterdam in 2024 prices, which is set at 100.

The mid-range ICC index values for the European cities included in the 100 locations listed in the report are shown in figure 14. London has the highest cost index overall and all the British cities on the list are within the top 20.

Figure 14: 2024 ICC index values – European Cities

Rank	City	Index
1	**London**	**223**
2	Geneva	218
3	Zurich	201
4	Munich	200
8	Copenhagen	181
12	**Manchester**	**176**
14	**Birmingham**	**173**
15	**Edinburgh**	**169**
16	**Cardiff**	**167**
18	**Glasgow**	**166**
19	**Dublin**	**163**
23	Oslo	155
25	Berlin	153
26	Vienna	149
28	**Belfast**	**145**
31	Stockholm	140
32	Nice	140
35	Paris	137
37	Frankfurt	134
38	Brussels	134
40	Luxembourg	133
41	Marseille	133
42	Lyon	133
44	Helsinki	132
56	Rome	112
57	Milan	112
58	Bratislava	111
64	Warsaw	100
65	*Amsterdam*	*100*
66	Budapest	97
68	Zagreb	93
69	Krakow	90

71	Athens	89
72	Prague	89
73	Istanbul	89
75	Lisbon	88
76	Sofia	88
77	Riga	87
78	Barcelona	84
82	Madrid	77

Source: International Construction Costs 2024 - Arcadis

The ICC index values for the locations of the Top 25 airports in Europe by passenger numbers are compared in figure 15. Clearly, location has a large influence on construction costs in general. London, the location of the no.1 airport (Heathrow), has an ICC value of 223, whereas the locations of next six most busy airports (Istanbul, Charles de Gaulle, Schiphol, Madrid, Frankfurt and Barcelona) have ICC values of 89, 137, 100, 77, 134 and 84 respectively. Costs at Heathrow are, therefore, likely to be significantly higher than at most other major airports in Europe.

Figure 15: ICC index values at the 25 busiest airports in Europe

Rank	Airport	Passengers per year 2023 (million)	Location	ICC Index
1	**Heathrow**	**79.2**	**London**	**223**
2	Istanbul	76.2	Istanbul	89
3	Charles De Gaulle	67.4	Paris	137
4	Schiphol	61.9	Amsterdam	100
5	Adolfo Suarez	60.2	Madrid	77
6	Frankfurt am Main	59.4	Frankfurt	134
7	Barcelona El-Prat	49.9	Barcelona	84
8	**Gatwick**	**40.9**	**South East England**	**N/A**
9	Leonardo da Vinci	40.5	Rome	112
10	Munich International	37.0	Munich	200
11	Lisbon	33.6	Lison	88
12	Dublin	33.5	Dublin	163
13	Orly	32.3	Paris	137
14	Palma de Majorca	31.1	Majorca	N/A
15	Vienna International	29.5	Vienna	149
16	Zurich	28.9	Zurich	201

17	Athens International	28.2	Athens	89
18	**Manchester**	**28.1**	**Manchester**	**176**
19	**Stansted**	**28.0**	**East England**	**N/A**
20	Copenhagen	26.8	Copenhagen	181
21	Malpensa	26.1	Milan	112
22	Oslo	25.1	Oslo	155
23	Brandenberg	23.1	Berlin	153
24	Malaga	22.3	Malaga	N/A
25	Brussels	22.2	Brussels	134

Source: International Construction Costs 2024 – Arcadis

Highly Serviced Buildings

Arcadis also produces an index for highly serviced building construction costs (HSB CC index), for buildings that features building services plant and systems within the completed building shell that exceed at least 50% of total project value. All client fit-out such as data halls, production equipment and associated utilities are excluded from the scope of the factor. The most representative building type covered by the HSB index is a data centre. As for the main index, the HSB CC index indicates the relative cost compared to costs in Amsterdam in 2024 prices, which is set at 100.

The HSB index range is narrower than the main ICC, reflecting the application of global specification standards for some highly serviced buildings such as data centres resulting in reduced scope for local variation.

The mid-range HSB CC index values for the European cities included in the 30 locations listed in the report are shown in figure 16. London has the highest cost index overall and both the British cities on the list are greater than 100.

Figure 16: 2024 HSB CC index values – European Cities

Rank	City	Index
1	**London**	**114**
3	Zurich	113
4	Copenhagen	112
5	Munich	112
6	Manchester	108
7	Oslo	108
8	Dublin	104
12	Berlin	103
13	Helsinki	103
14	Stockholm	101
16	***Amsterdam***	***100***

17	Brussels	100
18	Frankfurt	100
19	**Paris**	**100**
23	Madrid	97
24	Milan	97
28	Warsaw	90

Source: International Construction Costs 2024 – Arcadis

5.8 Summary

In addition to the specific geographical factors identified above, there are a range of influencing themes specific to the UK construction sector which contribute to the cost of construction.

The National Infrastructure Commission Report *Cost drivers of major infrastructure projects in the UK – October 2024* identified four main themes that contribute to increased costs and schedule delays in the development of infrastructure projects (see section 3.2), including consenting and compliance. The UK planning, building and environmental regulations should be considered as a factor when considering the causes of higher construction costs in the UK

Planning

The UK's planning system is known to be particularly complex and challenging to navigate, a problem recognised by the UK Government who in 2020 consulted on reforming the planning system. Generally, the UK's planning arrangements are considered more complex and time consuming when compared with other developed economies.

The UK has a discretionary planning approval system which applies to every development, whereas many other countries use "zoning" with permitted development within zones defined in a national or regional plan. Planning complexities and local requirements add delays and inefficiency to the process of design and construction, which in turn can lead to additional costs. Challenges such as managing objections and appeals, mitigating against issues identified through Environmental Impact Assessments, heritage requirements, building control and a slow and inefficient planning and decision process are all commonplace.

A report[5] by the National Infrastructure Commission in 2023 identified that since the Nationally Significant Infrastructure Project planning regime was established in 2008 consenting times have increased by 65 per cent since 2012, moving from 2.6 to 4.2 years, and the rate of judicial review increased to 58 per cent from a long-term average of ten per cent. National Policy Statements had not been updated since they were first issued and had not been supported by clear supplementary guidance.

The National Planning Policy Framework (NPPF) was recently revised in response to the national consultation. Whilst the consultation was primarily focused on ways to unlock additional housing development, it also considered infrastructure, green energy plus fees and cost recovery for local authorities related to Nationally Significant Infrastructure Projects.

[5] Delivering net zero, climate resilience and growth - Improving nationally significant infrastructure planning; National Infrastructure Commission: April 2023

In 2024 the new UK Government announced its intention to speed up the planning process although this has yet to be delivered.

Building Regulations

The Building Regulations in England and Wales set out the requirements for buildings to comply with legislation and cover aspects such as workmanship, adequate materials, structure, weather/waterproofing, fire safety and means of escape, sound isolation, ventilation, safe (potable) water, protection from falling, drainage, sanitary facilities, accessibility and facilities for the disabled, measures to limit overheating in new dwellings, electrical safety, security of a building, high-speed broadband infrastructure connections, and the installation of a minimum number of facilities for the charging of electric vehicles in all new buildings (commercial and domestic).

The Building Safety Act 2022 included additional regulations on aspects such as fire safety, fire resistant materials, cladding, inspection requirements and the establishment of the Building Safety Regulator as the Building Control Authority for all higher risk buildings in England. This represents a strengthening of regulatory oversight, with building work on higher-risk buildings having to pass through a rigorous process consisting of three gateway points. An article by professional services consultant AECOM in August 2024 identified that the changes to the Act will mean it is “likely to be that typical project programmes will extend” and that clients “will need to factor in higher hold costs at the end of the project”. This has some similarity to building regulations in other developed economies and will also be cost driver in these countries.

Energy Efficiency

Part L of the Building Regulations controls the insulation values of building elements, allowable window areas, doors and other openings, air permeability, heating efficiency of boilers, insulation and controls for heating, together with hot water storage and lighting efficiency. Energy efficiency and sustainability regulations for buildings have been updated through the amendments which set higher than previous standards for low carbon technologies, achieving certain U-values for thermal transmittance and use of renewable energy. An article by Savills in February 2021 suggests that increases to building costs required to implement the uplift to Part L standards range from “£3,000 to £5,000 per unit” according to major housebuilder MHCLG. This is likely to be replicated in other sectors. This is a factor driving costs and this is also the case across the other developed economies.

Accessibility

The UK’s Equality Act 2010 mandates that buildings must be accessible to all which requires design and construction to take account of wheelchair access, lift access, signage and broader facilities for accessibility. This is covered within the Building Regulations. Again, many developed economies have similar requirements, and the UK is likely to be within the category of countries who experience this as a contributing factor to construction cost.

Overall, while the Building Regulations do influence construction cost they are unlikely to explain the large difference in costs between London and, say, Amsterdam.

Contracting Model

Typically, in the UK the contracting model involves multiple layers of subcontracting, more than in other countries like France, for example. A number of studies and papers have identified this challenge in the UK, dating back to the Emmerson Report (1962) and Latham Report (1994) all the way up to the Government Construction Strategy 2016-2020 which

have all identified significant market fragmentation when compared to countries like USA, France and Germany. In addition Construction 2025 (2013) that the industry included for almost 1 million small and medium sized business which accounted for 99% of the industry's businesses. This adds layers of management cost, risk allowances and profit on top of the basic building cost.

5.9 Conclusion

Geographical factors have a significant influence on the cost of construction works at Heathrow compared to other locations. Heathrow has good transport links and is well connected to London and its labour force and construction companies, which makes it part of the London market. However, London has the highest construction prices in the UK, 21% above the national average and 12% greater than the adjacent South-East region. This is reflected in regional wage differences. London is also the most expensive city in Europe to undertake construction projects for both typical and highly serviced buildings. Therefore, construction prices at Heathrow should be expected to be significantly greater than at other UK airports before the physical and operational constraints at Heathrow Airport are taken into account.

6 Conclusions

6.1 Conclusions

Heathrow Airport does experience cost drivers over and above those typically identified in the construction sector when compared with projects delivered in non-regulated sectors. Seven factors have been identified as likely key cost drivers. Four factors have been identified as likely cost drivers but within an expected range. One factor has been identified as not likely to be a particular cost driver.

The likely key cost drivers identified are:

1) **Development and Delivery Capability (client and supply chain):** There is a large portfolio of projects delivered by HAL which requires increased management costs and also provides investment certainty to the supply chain.

2) **Governance, Assurance and Decision Making:** The approvals process and number of stakeholders and their influence adds time and cost for HAL.

3) **Airport Operational Environment:** The airport operational environment presents unique challenges, including security requirements, logistics of working in the Central Terminal Area (CTA) and airside and the need for nighttime working.

4) **Multiple Terminal Operation:** The size of the HAL estate, multiple terminals and large number of ageing assets managed by HAL result in more complex programmes and the need for more works, leading to increased costs.

5) **End User and Stakeholder Requirements and Profiles:** The large number of stakeholder interfaces with HAL, and the influence of these stakeholders result in additional layers of governance, increasing costs.

6) **Regulatory Framework and Airline Governance:** The airports regulatory framework and airline governance at HAL lead to an increased focus on change control, requiring additional resources.

7) **Geographic location:** The geographical location of Heathrow Airport in London leads to higher construction costs due to regional price differences, location factors, and intense competition for resources within the region. These are exacerbated by the additional costs of construction in the UK driven by regulation and planning law. These factors contribute to the overall cost premium associated with capex delivery at Heathrow

The following factors are likely cost drivers, but within an expected range:

1) **Organisational Structure and Maturity, inc. Technology and Data Strategy:** HAL requires a large organisational structure driven by volume of works, regulatory obligations, stakeholders.

2) **Commercial Strategy, Contracting Approach and Procurement:** At HAL, the use of frameworks and mature supply chain procurement reduces tendering requirements and tender costs compared to typical one-off procurements. However, at HAL the

nature of the work and the risk of disruption often requires a flexible contracting approach, e.g. cost reimbursable contracts.

3) **Project Management, Cost, Schedule, Benefits and Controls:** The use of a central Programme Management Organisation (PMO) and additional control processes and procedures are an additional cost compared to projects which do not require this level of control. The scale and complexity of the programme HAL manage requires a central PMO, adding cost.

4) **Design, Engineering and Scope Definition:** National airport specific standards and HAL specific requirements result in additional design and construction costs. The influence of airlines in the Delivery Obligations (DO) and design development is unique to HAL and adds time and cost. HAL's approach to scoping, ECI, planning and consents is robust and likely to mitigate the effects of the cost drivers to some extent.

The following factor is not likely to be a cost driver:

1) **Risk and Opportunity Management, inc. Compliance:** Risk allocation and management appears to be comparatively well balanced in terms of the level of effort mitigating risk and maximising opportunity

Final Considerations:

Heathrow Airport operates in a unique environment where the airport factors compound to create challenging delivery conditions. The airport is the busiest in the Europe with 80 million passengers using two runways. The airport also runs at 97% occupancy and is located in London which is the most expensive location in Europe to build, meaning the complexities of capex delivery at Heathrow will come at a premium. The operational area and multitude of assets, compounded by an environment at almost maximum occupancy, means that the way HAL deliver projects is complex and requires additional layers of 'site specific' costs. The base cost rates used by HAL contain allowances for reductions in productivity to account for the environment in which they will be used. The rates also take into account reductions in productivity due to:

- Working windows that are shorter than standard
- Night working and operational measures such increased numbers of material movements
- Additional overheads and fees for both the contracting entity and HAL which are specific to delivery at the airport.

This means that the cost base used by HAL has to contain elements of 'site-specific' costs which are then multiplied by the need for further site-specific overheads. There are various similarities to other regulated sectors, which also have higher construction costs when compared with general non-regulated construction, with a reliance on skilled workers and a permit system in place for accredited labour and staff.

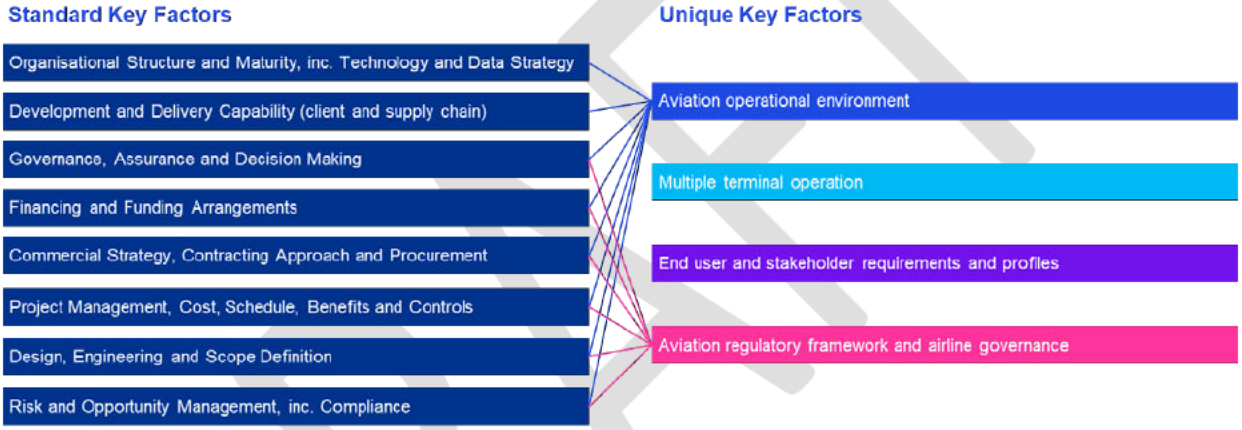
In summary, HAL requires a large portfolio management organisation to manage multiple programmes of projects. These have to be delivered in constrained operational areas across multiple terminals, influenced by numerous stakeholder requirements, delivered within a regulatory framework, which ultimately results in a complex and challenging delivery environment.

Appendix 1: Key Factors

Delivering large-scale capital projects requires managing standard key factors from the client perspective that demand complex coordination, substantial resources, and the handling of numerous interconnected risks and opportunities.

In addition, projects also face the challenge of unique key factors which are applicable to their delivery context – Heathrow has a combination of unique operational environment and aviation sector factors in addition to geographical location in London / South East of England.

Capital cost performance and the achievement of delivery efficiency are inevitably influenced by an organisation's ability to manage the specific combination of the standard key factors and unique key factors specific to airport projects. The key factors considered in our review are listed below.



Appendix 2: Infrastructure Case Studies

Case Study 1: Crossrail

Project Overview:

Crossrail, the Elizabeth Line, connects east and west London with new tunnels and stations. The scope included 73 miles of new/upgraded railway with 26 miles of tunnelling, stopping at 41 stations, 10 of which were new, and rolling stock, to increase capacity on existing lines. However, the project experienced significant delays and cost overruns, reaching a final cost of £18.9 billion.

Key Factors Impacted:

1. Organisational Structure and Maturity, Including Technology and Data Strategy

N/A

2. Development and Delivery Capability (Client and Supply Chain)

While CRL had a skilled team, it lacked sufficient expertise in rail programme delivery initially, which became critical in later phases (*DfT, 2024*).

The scale and complexity of Crossrail demanded significant capabilities from both the client organisation and the supply chain. However, the project encountered several challenges that hindered efficient delivery. Misaligned objectives and varying levels of expertise among contractors led to inefficiencies, particularly when managing the integration of different systems and technologies (*Crossrail Learning Legacy, 2020*).

The project also faced coordination challenges among suppliers. The integration of advanced systems, such as signalling and rolling stock, required close collaboration across multiple stakeholders. This became especially critical during testing, commissioning, and regulatory assurance stages, where delays and rework were frequent. Neither Crossrail, the sponsors nor the contractors appreciated how complex it would be to bring together the systems and assets, or how long it would take. (NAO, 2021)

3. Governance, Assurance, and Decision-Making

The *Department for Transport (2024)* report highlights that while CRL employed a "three lines of defence" framework, encompassing governance at the Board level, programme integration oversight, and project management execution, these mechanisms were not always applied effectively. This inadequacy often left emerging risks and challenges unaddressed until they became critical, further impacting costs and delivery schedules.

The assurance processes were another area of concern. The project suffered from insufficiently robust assurance reviews, particularly during critical phases such as testing and commissioning. The absence of effective, timely assurance contributed to delays in achieving safety and operational readiness, revealing gaps in governance and decision-making structures.

4. Commercial Strategy, Contracting Approach, and Procurement

Crossrail employed the New Engineering Contract (NEC) initially using incentivised target costs. Due to slippage on work packages the incentive framework became impossible to

operate and most suppliers moved to a cost reimbursable form. There were no incentives on contractors relating to integration and these contracts created an incentive for suppliers to overstate progress or prolong work. (*DfT, 2024*).

5. Project Management, Cost, Schedule, Benefits, and Controls

Optimistic initial schedules did not fully account for the project's complexities. The performance metrics used were construction-centric and failed to reflect the intricacies of systems integration, delaying identification of risks and issues (*DfT, 2024*).

The Public Accounts Committee criticised the unrealistic timelines and budgets, which contributed significantly to cost overruns (*House of Commons, 2019*).

6. Design, Engineering, and Scope Definition

The evolving project scope and the underestimation of integration complexity caused delays and cost escalations. *DfT (2024)*

7. Risk and Opportunity Management, Including Compliance

The compressed delivery schedule and insufficient early identification of risks were significant contributors to delays and cost increases (*NAO, 2021*).

References

- Department for Transport. (2024). *Sponsoring a Major Project: The Crossrail Experience*.
- Crossrail Learning Legacy. (2018). *Crossrail Project: Application of BIM (Building Information Modelling) and Lessons Learned*.
- Crossrail Learning Legacy. (2020). *Crossrail Systems Integration – Lessons Learned and Good Practice*.
- National Audit Office. (2021). *Crossrail – A Progress Update*.
- House of Commons Public Accounts Committee. (2019). *Government must explain who is responsible for Crossrail failures*.

Case Study 2: Thames Tideway Tunnel Project

Project Overview:

The Thames Tideway Tunnel is a major infrastructure project designed to modernise London's sewage system and improve water quality in the River Thames. The main component is the construction of a 15.5 mile tunnel running from west to east London. The tunnel will intercept, store and convey sewage and rainwater to Beckton Sewage Treatment Works.

Key Factors Impacted:

1. **Organisational Structure and Maturity, Including Technology and Data Strategy (N/A)**

2. **Development and Delivery Capability (Client and Supply Chain)**

A collaborative delivery model was established forming strong partnerships with experienced contractors under and alliance framework. Common goals were set with aligned incentives focused on generating programme and cost efficiencies. Early stage planning and risk management was undertaken through the use of early contractor involvement through a 6 month contractor involvement phase. (GIH)

Governance, Assurance, and Decision-Making

The governance framework for the Thames Tideway Tunnel includes oversight by regulatory bodies such as Ofwat and the Environment Agency. According to the National Audit Office (NAO) 2017 report, this governance structure has helped maintain regulatory compliance and financial accountability.

Commercial Strategy, Contracting Approach, and Procurement

The innovative delivery model was established to attract private sector capital to finance and delivery value for money for customers. (Waterbriefing) The project used the Special Infrastructure Projects Regulations in its procurement, ensuring compliance with regulatory standard. A variety of incentives were used such as project performance, project controls, social impact, pain/gain. These incentives were aligned at multiple levels from overall programme to consortia to single entity to ensure alignment of outcomes. (GIH)

5. Project Management, Cost, Schedule, Benefits, and Controls

6. Design, Engineering, and Scope Definition

Advanced design and procurement of items with long lead times was adopted. Co-location and collaboration with project owner, project management team, delivery consortia was attributed to this success. **(GIH)**

7. Risk and Opportunity Management, Including Compliance

Risk management strategies include comprehensive identification, mitigation, and management plans to address potential challenges during construction and operation. The NAO's 2017 review indicated that while Tideway's risk management was generally effective, early cost escalations suggested room for improvement in forecasting financial contingencies.

References

Global Infrastructure Hub (GIH), Thames Tideway – Improving Delivery Models Case Study

National Audit Office. (2017). Review of the Thames Tideway Tunnel.

Waterbriefing (2024), Tideway progresses to system commissioning stage of Tideway Tunnel delivery

Case Study 3: High Speed 2 (HS2) Project

Project Overview:

High Speed 2 (HS2) is a major infrastructure project in the United Kingdom that will now deliver 140 miles of new high-speed railway line with four new stations and rolling stock.

Case Study: High Speed 2 (HS2) – Key Factors Impacting Cost of Delivery

High Speed 2 (HS2) is a major infrastructure project aimed at enhancing the UK's rail network by providing high-speed connections between major cities. The project has encountered various challenges affecting its cost and delivery schedule. This case study examines the key factors influencing these outcomes, structured around seven critical areas.

1. Organisational Structure and Maturity, Including Technology and Data Strategy

HS2 Ltd, a non-departmental public body, is responsible for the development and delivery of the HS2 project. The organisational structure has faced scrutiny due to concerns over management effectiveness and strategic planning. The National Audit Office (NAO) reported that the Department for Transport (DfT) and HS2 Ltd have historically underestimated the complexity of the programme, leading to optimistic estimates and challenges in delivery (NAO, 2020).

2. Development and Delivery Capability (Client and Supply Chain)

The HS2 project has faced significant challenges related to development and delivery capabilities. Skills shortages in critical areas, including engineering and project management, have hampered progress. The Public Accounts Committee (PAC) noted that these shortages have led to an over-reliance on external consultancies and contractors, weakening the government's ability to act as an "intelligent client" (PAC, 2024)

Contractor performance issues have also been a recurring problem. The National Audit Office (NAO) reported delays and cost escalations due to inconsistent performance across the supply chain, highlighting the need for improved accountability and oversight (NAO, 2020).

Additionally, coordination and integration issues have complicated delivery. The project's scale and complexity require seamless collaboration between numerous contractors and stakeholders. Reports from the PAC emphasised that weaknesses in coordination have resulted in inefficiencies, affecting the project's ability to meet its objectives within the planned budget and timeline (PAC, 2024).

3. Governance, Assurance, and Decision-Making

N/A

4. Commercial Strategy, Contracting Approach, and Procurement

The commercial strategy and procurement approach for HS2 have encountered significant issues. Ineffective commercial partnerships with developers have contributed to inefficiencies, with delays in decision-making and scope alignment affecting project delivery. The National Audit Office (NAO) noted that a lack of clear commercial agreements led to coordination challenges and budget mismanagement (NAO, 2020).

The Public Accounts Committee (PAC) reported that contracting approach lacked the right commercial skills to manage the contracts. (PAC, 2024)

Procurement delays have also had a significant impact, exacerbated by contractor capacity and experience issues. (NAO, 2020)

5. Project Management, Cost, Schedule, Benefits, and Controls

HS2 has faced significant challenges in project management, leading to cost overruns and schedule delays. The NAO reported that HS2 Ltd must be transparent and provide realistic assessments of costs and completion dates, recognising the many risks to the successful delivery of the railway that remain (NAO, 2020).

6. Design, Engineering, and Scope Definition

The design and engineering aspects of HS2 have been subject to changes, impacting the project's scope and objectives. In addition, the PAC cite design performance a source of cost increase. (PAC, 2024)

7. Risk and Opportunity Management, Including Compliance

Risk management has been a critical area for HS2, with various challenges impacting the project's delivery. The NAO highlighted the need for HS2 Ltd to be transparent and provide realistic assessments of costs and completion dates, recognising the many risks to the successful delivery of the railway that remain (NAO, 2020).

Phase One used a methodology to carry out detailed analysis of its identified risks appropriate for programmes at later stages of development with a detailed design. This detailed analysis did not take enough account of the uncertainty inherent in the programme at this stage, and the likelihood that unidentified risks would emerge. (PAC, 2024).

References

- National Audit Office (2020) *High Speed Two: A progress update*.
- Public Accounts Committee (2024) *HS2 verdict: Scheme now very poor value for money after Northern leg cancellation*.

Case Study 4: London 2012 Olympics

Project Overview:

Key Factors Impacted:

1. **Organisational Structure and Maturity, Including Technology and Data Strategy**

The Olympic Delivery Authority (ODA) was established in 2006 to oversee the construction of the venues and infrastructure. The ODA worked closely with its delivery partner, CLM, a joint venture between CH2M Hill, Laing O'Rourke, and Mace. This partnership ensured clear roles and responsibilities and experienced leadership. (NEC)

2. Development and Delivery Capability (Client and Supply Chain)

Early contractor involvement (ECI) aided the design process, ensuring buildability which resulted in health and safety, cost and timescale benefits which ensured seamless integration of design and construction efforts. (Webster et al)

According to the Learning Legacy Report More than 8,000 subcontracting opportunities were created by the ODA construction programme. All contracts were advertised on a procurement platform with small/medium enterprises given support by the ODA to apply for these contracts.

2. **Governance, Assurance, and Decision-Making**

The ODA was accountable to the UK government's Department for Culture, Media and Sport (DCMS) and had an independent board. The ODA implemented regular reviews and independent assurance mechanisms to ensure transparency and accountability (ICE)

4. Commercial Strategy, Contracting Approach, and Procurement (N/A)

5. Project Management, Cost, Schedule, Benefits, and Controls

The project adopted robust project management methodologies to monitor cost and schedule performance in real-time. According to the Learning Legacy Report, the ODA developed an integrated programme management approach to ensure alignment across around 50 major projects under its remit.

6. Design, Engineering, and Scope Definition (N/A)

7. Risk and Opportunity Management, Including Compliance

The ODA developed an extensive risk management framework and conducted regular audits to identify and mitigate risks. This proactive approach helped ensure the successful delivery of the project. (NEC)

References

NEC, London Olympic Park Case Study

Webster, Mike & Lloyd-Kendall, Elizabeth. (2012). London 2012: The Construction (Design and Management) Regulations 2007: Duty holder roles and impact.

ICE, Delivering London 2012 (2011): organisation and programme

Learning Legacy (2013). Lessons Learned from the London 2012 Games Construction Project

Case Study 5: Heathrow Terminal 5

Project Overview:

The Heathrow Terminal 5 (T5) project involved the construction of a new terminal building, control tower, car park, hotel, and logistics links at Heathrow Airport. The project was completed in 2008 at a cost of £4.3 billion.

Key Factors Impacted:

1. Organisational Structure and Maturity, Including Technology and Data Strategy

Heathrow Airport Limited (HAL) implemented a decentralised management structure with an integrated project team, enabling collaboration across contractors, suppliers, and stakeholders. This structure allowed HAL to manage complexity effectively and maintain alignment with project objectives (Gil et al., 2011).

2. Development and Delivery Capability (Client and Supply Chain)

HAL engaged with over 60 first-tier contractors and 20,000 suppliers, requiring a highly integrated supply chain. Early engagement and collaboration were central to managing this complexity. The project's supply chain strategy emphasised shared goals and open communication, reducing the risk of misalignment (National Audit Office, 2005).

HAL's decision to retain full risk ownership allowed contractors to focus solely on execution, enhancing productivity and reducing variability in delivery outcomes (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

3. Governance, Assurance, and Decision-Making

Governance for T5 featured clear oversight by HAL, with regular independent reviews and audits to ensure accountability. Decentralised decision-making empowered contractors and managers, enabling rapid responses to project challenges (Gil et al., 2011).

The adoption of the Last Responsible Moment (LRM) strategy delayed key decisions until the latest feasible point. This ensured that decisions were informed by current data, reducing the likelihood of costly rework (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

4. Commercial Strategy, Contracting Approach, and Procurement

The T5 Agreement was a ground-breaking contractual model, assigning all risk responsibility to HAL and creating a collaborative, non-adversarial relationship between the client and contractors. This approach aligned incentives across stakeholders and minimised disputes (National Audit Office, 2005).

Lean procurement practices optimised resource allocation and eliminated inefficiencies, ensuring that contracts prioritised value delivery and streamlined execution (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

5. Project Management, Cost, Schedule, Benefits, and Controls

HAL's risk pooling strategy aggregated risks across the supply chain, reducing variability and limiting the need for excessive contingency reserves. This innovative approach improved the project's overall stability and control (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

Performance-based contracts incentivised contractors to meet key milestones. These measures, combined with iterative planning cycles, ensured that T5 was delivered within budget and on time (Gil et al., 2011).

6. Design, Engineering, and Scope Definition

The integration of lean construction principles into the design phase allowed HAL to align project scope with delivery requirements effectively. This approach reduced inefficiencies and ensured that potential risks were addressed early (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

The design process was also informed by collaborative input from contractors and suppliers, ensuring that deliverables were both practical and aligned with operational needs (Gil et al., 2011).

7. Risk and Opportunity Management, Including Compliance

Risk management was central to the T5 programme. HAL retained ownership of systemic risks, ensuring consistent oversight and coordination across the project. Risk pooling further reduced uncertainty by aggregating individual supplier risks, enhancing predictability and resilience (Risk and Uncertainty Management in the Heathrow Terminal 5 Programme, 2020).

The project's decentralised decision-making framework allowed risks to be addressed proactively, ensuring that responses were well-informed and timely (Gil et al., 2011).

References

1. Risk and Uncertainty Management in the Heathrow Terminal 5 Programme (2020). *Risk and Uncertainty Management in the Heathrow Terminal 5 Programme*.
2. Gil, N., et al. (2011). *Leadership in Megaprojects: Lessons from Heathrow Terminal 5*.
3. National Audit Office (2005). *Improving Public Services through Better Construction: Case Studies*.
4. Structures Insider (2021). *HS2 and Heathrow T5: A Case Study on Project Management Influence*.

Appendix 3: Heathrow Case Studies

Heathrow Case Study 1: Hold Baggage Screening Right Hand Side G3 (B71-041.00)

Project Overview: This project entails the completion of the Right-Hand-Side (RHS) installation for the baggage handling system at Terminal 4. The project builds upon a previous Standard 3 Hold Baggage Screening (HBS) project (BC216) that successfully implemented the Left-Hand-Side (LHS) of the system. Due to the COVID-19 pandemic, the initial contract was terminated via Deed of Amendment 8, leaving the RHS installation incomplete.

This project is for the remaining RHS works, and all associated defined activities, which include, but are not limited to, progressive replacement of existing baggage handling transport systems and HBS systems, together with connections to interfacing LHS and planned High Level Control systems platform (provided by a third-party contractor under a separate concurrent, integration contract).

In addition, the RHS Works include associated enabling, temporary and permanent structural, civil and building construction work, together with mechanical and electrical building services entailing security and life safety systems reconfiguration.

Project Cost: [redacted]

Project Cost Split:

Item	Cost	Percentage
Building Works	[redacted]	[redacted]
Prelims, Overheads and Profit	[redacted]	[redacted]
Design	[redacted]	[redacted]
Other Development/project Costs	[redacted]	[redacted]
Contractor/DI owned risks incl. OHP	[redacted]	[redacted]
HAL owned Risks	[redacted]	[redacted]
Inflation	[redacted]	[redacted]
HAL Logistics and Leadership	[redacted]	[redacted]
Total Project Cost	[redacted]	

Project Schedule: Start date 14/10/24 with anticipated completion at 28/03/28 (Gate 0 18/11/22 to Gate 3 21/11/24

Table: Identification of factors Case Study 1

	Area	Factor	RHS Baggage System Observations	Factor Present
1	Airport operational environment	Security requirements	Staff require to be screened and attend briefing at beginning of shift prior to progressing to work area	Y
		Airside working restrictions (FOD etc)	N/A	N
		Logistics of working in CTA and airside	The working area affords minimal storage with materials brought in as required for central logistics. The problem is further compounded by the working area itself, generally materials are limited to those which can be moved by forklift within the working area	Y
			Steel installation is impacted with bespoke smaller lengths of steel used rather than standard. This is due to the restrictions in the working area and results in additional material costs and reduced productivity with additional handling and welding. However, the steel costs bench within Heathrow experienced norms.	Y
			Embargo days result in an additional cost of [redacted] of standing time	Y
			Reduced productivity held within base costs to account for travel to and from welfare, briefings etc	Y
			Some elements of works can be carried out in the day within a safe distance from the live baggage environment. Additionally, the sensitive nature of baggage handling works and to mitigate impacts to LHS baggage system have resulted in a mitigation measure of £10m	Y
		Need for nighttime working	Limited opportunities to carry out works in daytime due to risk of impact to live operational environment, additionally material deliveries can only be at night.	Y
2	Multiple terminal operation	Multiple terminals Large number of assets Asset age	Age of assets and requirement to replace/maintain assets within a live working environment result in additional costs.	Y
		Connections to public transport Road access	No issues identified with transport to and from Heathrow	N

3	End user and stakeholder requirements and profiles	Passenger, airline, ground handling, retail, etc requirements	Sensitivity of baggage handling requires a baggage handling steering group to approve the project. In addition, airlines are cautious of the potential impact to customers resulting in mitigations.	Y
		Completion deadlines Stakeholder milestones/deadlines	Project has been in development for 2 years to reach start on site approval with a programme for a further 4 years to full completion.	Y
		Industry standards User technical requirements	Complex integration with High Level System under a separate contract but Low-Level Integration in scope. Baggage integrator Beumer represents highest package cost at £27m with limited market for competition due to complex works.	Y
4	Regulatory framework and airline governance	Regulatory obligations	HAL logistics and leadership costs at [redacted]	Y
			Two years from problem statement to approval to start on site, noting that project was part of a terminated project.	Y

The completion of the RHS installation for the Terminal 4 baggage handling system at Heathrow Airport is influenced by various factors. These factors can be broadly summarised into four key areas:

Airport Operational Environment: Security screening and briefings for workers result in reduced working windows affecting productivity. Working restrictions limit material storage and necessitate just-in-time deliveries, increasing logistical challenges. Embargo days result in significant cost increases due to standing time. Nighttime working is often required to minimise disruption to live operations, impacting productivity and incurring additional costs.

Multiple Terminal Operation: The presence of multiple terminals running at 97% capacity brings about resilience challenges. The large number of assets necessitates careful coordination and planning to avoid disruptions adding to project costs.

End User and Stakeholder Requirements: The sensitivity of baggage handling operations necessitates a dedicated steering group and stakeholder approvals, adding to project complexity and timelines.

Regulatory Framework: Regulatory obligations and airline governance processes contribute to extended project development and approval timelines.

Heathrow Case Study 2: Rail OTN & PLC Replacement (B6206.13)

Project Overview

The project requires the replacement of the Optical Transport Network (OTN) and Programmable Logic Cover (PLC) for the existing rail system. The current network has been in place for 25 years since its initial deployment and whilst the project is for a like-for-like replacement, the network will be designed to comply with latest HAL standards and recommendations including cyber security. The project will replicate the current design by using spare fibre cores on the existing fibre infrastructure. Where capacity is exhausted of not usable, new fibres and cable management will be installed. In some sites, new cabinets will be required, including new fibre, CAT 6 and copper infrastructure. The project will also make provision for the replacement ventilation and utility PLC network.

Project Cost: [redacted]

Project Cost Split:

Item	Cost	Percentage
Building Works	[redacted]	[redacted]
Prelims, Overheads and Profit	[redacted]	[redacted]
Design	[redacted]	[redacted]
Other Development/project Costs	[redacted]	[redacted]
Contractor/DI owned risks incl. OHP	[redacted]	[redacted]
HAL owned Risks	[redacted]	[redacted]
Inflation	[redacted]	[redacted]
HAL Logistics and Leadership	[redacted]	[redacted]
Total Project Cost	[redacted]	

Project Schedule: Start date 21/03/25 with anticipated completion at 16/06/28 (Gate 1 23/11/21 to Gate 3 19/09/24)

Table: Identification of factors Case Study 2

	Area	Factor	RHS Baggage System Observations	Factor Present
1	Airport operational environment	Security requirements	Staff require to be screened and attend briefing at beginning of shift prior to progressing to work area	Y
		Logistics of working in CTA and airside	Pre-preparation required prior to every shift with access to cabling via entry points	Y
			Shutdown in November for 72 hours for maintenance will be used as an opportunity to move equipment into required areas	Y
			Reduced productivity held within base costs to account for travel to and from welfare, briefings etc	Y
			Works are in the rail environment and require to be operational the next day with no impact to passengers reducing working window due to operational checks required	Y
		Need for nighttime working	Works are carried out in the rail environment meaning there is no opportunity for day working	Y
2	Multiple terminal operation	Multiple terminals Large number of assets Asset age	Age of assets and requirement to replace/maintain assets within a live working environment result in additional costs.	Y
		Connections to public transport Road access	No issues identified with transport to and from Heathrow	N
3	End user and stakeholder requirements and profiles	Passenger, airline, ground handling, retail, etc requirements	Live rail network must be operational on a daily basis to ensure passenger transport	Y
		Completion deadlines Stakeholder milestones/deadlines	Project has been in development for 3 years to reach start on site approval with a programme for a further 3 years to full completion.	Y
		Industry standards User technical requirements	Like-for-like replacement requires to be in accordance with latest HAL standards and recommendations	Y

	Area	Factor	RHS Baggage System Observations	Factor Present
4	Regulatory framework and airline governance	Regulatory obligations	HAL logistics and leadership costs at [redacted]	Y
			[redacted] of the total project cost has been spent on early procurement and design with Fujitsu to ensure cost certainty and mitigate delays.	Y

The completion of the Rail OTN and PLC replacement project is influenced by various factors. These factors are summarised into four key areas:

Airport Operational Environment: Security screening and briefings for workers result in reduced working windows affecting productivity. Working restrictions limit material storage and require pre-preparation for a shift. A 72-hour maintenance shutdown is being utilised to transport to move equipment. There are no opportunities for day working, with nights the only option.

Multiple Terminal Operation: The age of assets and difficulties to replace/maintain due to the operational environment led to additional costs.

End User and Stakeholder Requirements: The rail network must be operational on a daily basis resulting in operational checks are the end of every shift, additionally the project has taken 3 years to progress from Gateway 1 to Gateway 3 with 4 steering groups required to approve at each gateway.

Regulatory Framework: Regulatory obligations and the move from Ex Post to Ex Ante results in a greater need for cost and schedule certainty. [redacted] has been spent on early design and procurement to minimise risks.

Heathrow Case Study 3: Airfield Pavement Rolling Lifecycle (B71-099.00)

Project Overview:

This project entails the renovation of asphalt and concrete pavements on the airfield surfaces. This project focusses on asphalt works at blocks 67-70 and concrete works to blocks 104 and 120. Works at block 120 may be carried out in the day with all other blocks required at night.

Project Cost: [redacted]

Project Cost Split:

Item	Cost	Percentage
Building Works	[redacted]	[redacted]
Prelims, Overheads and Profit	[redacted]	[redacted]
Design	[redacted]	[redacted]
Other Development/project Costs	[redacted]	[redacted]
Contractor/DI owned risks incl. OHP	[redacted]	[redacted]
HAL owned Risks	[redacted]	[redacted]
Inflation	[redacted]	[redacted]
HAL Logistics and Leadership	[redacted]	[redacted]
Total Project Cost	[redacted]	

Project Schedule: Start date 31/01/24 with anticipated completion at 2/05/25 (Gate 0 12/01/24 to Gate 3 21/03/24)

Table: Identification of factors Case Study 3

	Area	Factor	RHS Baggage System Observations	Factor Present
1	Airport operational environment	Security requirements	Staff require to be screened and attend briefing at beginning of shift prior to progressing to work area	Y
		Airside working restrictions (FOD etc)	Airfield pavement works are carried out airside and subject to operation and security constraints	Y
		Logistics of working in CTA and airside	Paving machine requires to be sat on a stand at Heathrow impacting the operational area	Y
			Reduced productivity held within base costs to account for travel to and from welfare, briefings etc	
			Batching equipment is available airside, supplied by a third supplier, assumed a cost premium is paid	Y
		Need for nighttime working	Only works at block 120 may be carried out in the day, 4 hour assumed productivity at night	Y
2	Multiple terminal operation	Multiple terminals Large number of assets Asset age	Pavements are in differing conditions and decisions to re-screed concrete or asphalt are taken dependant on criticality needs of the proposed area. This can result in a bias to use asphalt which has a lower design life than concrete	Y
		Connections to public transport Road access	No issues identified with transport to and from Heathrow	N
3	End user and stakeholder requirements and profiles	Passenger, airline, ground handling, retail, etc requirements	No known impact	Y
		Completion deadlines Stakeholder milestones/deadlines	Project has benefitted from being part of a rolling programme with standard designs. Timescale from Need to Investment Decision was 3 months which is comparatively fast	N
		Industry standards User technical requirements	Standard designs and the project is part of an overall programme of works	Y

	Area	Factor	RHS Baggage System Observations	Factor Present
4	Regulatory framework and airline governance	Regulatory obligations	[redacted] of the project cost is HAL logistics and Leadership and HAL owned risks demonstrating the additional cost associated with governance and project management at Heathrow	Y

The renovation of asphalt and concrete pavements on the airfield surfaces at Heathrow Airport is a complex project influenced by various factors. These factors can be broadly summarised into four key areas:

Airport Operational Environment: Security requirements necessitate additional screening and briefings for workers, impacting productivity. The presence of a paving machine on a stand at Heathrow impacts the operational area. Nighttime working is required for most blocks to minimise disruption to live operations, impacting productivity and incurring additional costs.

Multiple Terminal Operation: The age of existing pavements requires ongoing replacement and maintenance, adding to project costs. Decisions to re-screed concrete or asphalt are taken based on criticality needs, potentially leading to a bias towards asphalt with a lower design life.

End User and Stakeholder Requirements: No significant impact from end user and stakeholder requirements has been identified. The project has benefitted from being part of a rolling program with standard designs, facilitating faster approval processes.

Regulatory Framework: A significant portion of the project cost is attributed to HAL logistics and leadership and HAL-owned risks, demonstrating the additional cost associated with governance and project management at Heathrow.

1 Case Study Key Factor Presence

The presence of airport specific factors in each case study is summarised in the table below:

Airport Key Factors Seen in Heathrow Case Studies

	Area	Factor	RHS Baggage System	Rail	Rolling Pavement Replacement
1	Airport operational environment	Security requirements	Y	Y	Y
		Airside working restrictions (FOD etc)	N	Y	Y
		Logistics of working in CTA and airside	Y	Y	Y
		Need for nighttime working	Y	Y	Y
2	Multiple terminal operation	Multiple terminals Large number of assets Asset age	Y	Y	Y
		Connections to public transport Road access	N	N	N
3	End user and stakeholder requirements and profiles	Passenger, airline, ground handling, retail, etc requirements	Y	Y	Y
		Completion deadlines Stakeholder milestones/deadlines	Y	Y	N
		Industry standards User technical requirements	Y	Y	Y
4	Regulatory framework and airline governance	Regulatory obligations	Y	Y	Y

Appendix 4: Geographical Cost Data

BCIS Regional Tender Price Indices (RTPI)

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
Date											
Feb-2000	73	74	78	73	75	72	74	70	71	75	68
May-2000	73	75	78	72	76	72	74	70	72	75	69
Aug-2000	77	78	81	75	80	74	77	73	75	78	72
Nov-2000	78	79	83	76	81	75	78	74	76	79	73
Feb-2001	79	80	85	77	82	76	79	75	78	80	74
May-2001	80	81	87	78	82	76	80	76	79	81	75
Aug-2001	81	83	89	80	83	78	82	77	81	83	76
Nov-2001	84	86	92	82	86	81	84	79	84	85	79
Feb-2002	83	85	91	81	85	81	84	78	84	84	78
May-2002	85	88	93	84	88	82	86	80	86	86	81
Aug-2002	87	91	94	86	90	84	89	82	87	88	83
Nov-2002	89	93	96	88	93	85	91	85	89	91	86
Feb-2003	89	93	96	90	94	86	92	85	90	92	87
May-2003	89	93	96	91	96	87	92	86	91	93	88
Aug-2003	91	95	98	94	98	89	94	89	93	95	91

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
Nov-2003	90	93	95	93	96	88	92	87	92	92	90
Feb-2004	92	95	96	95	99	90	94	89	94	94	93
May-2004	96	99	100	100	103	95	97	93	97	98	98
Aug-2004	99	101	102	103	105	98	99	96	99	101	102
Nov-2004	100	103	104	105	106	100	101	97	100	103	103
Feb-2005	102	105	105	108	108	104	102	99	102	105	106
May-2005	103	105	105	109	107	105	101	99	103	106	107
Aug-2005	101	103	104	109	106	105	100	97	102	104	107
Nov-2005	102	103	105	111	106	108	100	98	105	105	108
Feb-2006	105	105	107	115	109	112	103	101	108	108	111
May-2006	106	106	108	116	110	113	103	102	110	108	111
Aug-2006	104	103	105	113	107	111	101	99	108	105	107
Nov-2006	105	105	108	113	108	113	103	102	110	106	108
Feb-2007	106	106	111	113	109	115	105	104	113	108	108
May-2007	108	108	114	115	111	118	108	107	117	111	110
Aug-2007	111	111	118	117	115	122	112	112	121	114	112
Nov-2007	111	110	118	116	115	122	112	112	121	114	112
Feb-2008	113	112	121	117	117	124	114	114	123	116	113
May-2008	110	110	119	114	114	121	112	111	120	113	111

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
Aug-2008	108	108	118	111	112	118	111	109	117	111	109
Nov-2008	107	107	115	109	110	116	110	108	113	109	107
Feb-2009	102	101	109	103	104	109	104	102	106	103	101
May-2009	98	97	102	98	99	103	99	98	100	99	96
Aug-2009	99	98	102	99	99	103	100	100	100	99	98
Nov-2009	96	96	98	97	96	98	97	97	96	96	96
Feb-2010	97	98	99	99	99	99	99	99	99	98	98
May-2010	99	99	99	100	99	99	99	100	99	99	99
Aug-2010	101	101	101	100	101	101	101	100	101	101	101
Nov-2010	103	102	101	100	101	101	101	100	102	101	102
Feb-2011	102	102	101	99	100	100	101	100	102	101	102
May-2011	107	107	106	103	104	104	105	104	108	107	107
Aug-2011	106	107	107	102	104	104	106	104	109	106	107
Nov-2011	104	106	106	100	103	103	105	103	108	105	106
Feb-2012	103	104	106	99	102	101	104	102	107	104	105
May-2012	106	107	109	102	104	104	107	105	109	108	107
Aug-2012	104	105	107	102	102	102	106	103	107	105	105
Nov-2012	107	108	109	106	104	104	109	106	110	106	108
Feb-2013	109	111	110	109	106	106	111	107	111	107	109

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
May-2013	114	116	114	114	111	111	115	112	116	111	113
Aug-2013	112	114	112	113	110	109	114	109	114	110	111
Nov-2013	116	118	117	119	116	113	118	113	118	114	113
Feb-2014	119	120	121	123	120	116	121	115	120	117	116
May-2014	120	120	122	126	122	118	123	116	121	119	117
Aug-2014	126	124	128	130	128	124	129	121	124	125	121
Nov-2014	128	124	129	130	129	124	131	121	124	127	122
Feb-2015	132	127	133	133	133	126	135	124	127	131	126
May-2015	134	131	138	135	137	128	138	127	129	134	129
Aug-2015	134	131	138	134	137	126	137	127	127	135	129
Nov-2015	134	130	138	133	138	125	137	127	126	135	128
Feb-2016	137	133	141	135	141	126	140	129	127	138	130
May-2016	142	136	145	137	146	129	143	132	129	142	132
Aug-2016	144	134	144	139	143	131	143	132	131	140	131
Nov-2016	150	139	149	144	149	135	148	136	136	144	136
Feb-2017	156	144	155	149	154	140	153	141	141	149	140
May-2017	161	146	159	152	157	143	156	144	143	152	142
Aug-2017	161	146	159	151	157	142	155	144	143	151	142
Nov-2017	168	151	165	156	162	147	161	149	149	156	147

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
Feb-2018	172	155	171	160	167	151	165	153	154	160	151
May-2018	172	155	172	159	167	151	164	153	154	160	151
Aug-2018	173	156	173	160	167	152	164	154	155	160	152
Nov-2018	175	157	175	161	169	153	165	155	157	162	153
Feb-2019	176	157	176	161	170	154	165	156	158	162	154
May-2019	178	159	179	163	172	155	166	158	161	164	156
Aug-2019	178	159	178	163	174	156	166	158	162	164	156
Nov-2019	177	157	177	162	173	155	166	158	162	162	155
Feb-2020	177	158	177	162	176	155	167	159	162	164	156
May-2020	177	158	178	162	176	155	167	158	163	164	156
Aug-2020	174	155	175	160	174	153	165	156	160	163	153
Nov-2020	173	154	175	158	173	151	166	154	159	162	152
Feb-2021	172	154	174	158	173	152	167	154	159	162	152
May-2021	174	155	176	159	175	153	168	155	160	163	153
Aug-2021	178	159	181	162	179	158	173	159	164	166	156
Nov-2021	180	161	183	164	183	160	175	160	166	169	158
Feb-2022	182	163	185	166	185	163	176	161	168	173	159
May-2022	189	170	193	173	193	170	183	168	182	181	166
Aug-2022	192	172	196	175	196	173	185	171	186	185	168

Region:	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorkshire and the Humber
Nov-2022	194	174	197	177	198	174	186	172	189	187	170
Feb-2023	196	176	199	178	200	176	187	174	193	190	171
May-2023	198	179	201	180	203	177	189	175	197	192	173
Aug-2023	199	180	202	181	205	179	190	176	201	193	174
Nov-2023	200	181	203	182	205	179	191	177	204	194	175

Source: BCIS

Location Factors

Control Period	Q3			Q4					Q5							Q6								H7	
Location	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
London	118	119	119	117	116	115	114	114	114	114	113	113	114	114	114	116	117	119	121	122	123	122	123	122	121
South East	107	107	108	108	107	106	105	105	105	106	106	107	108	109	110	111	111	111	111	109	109	110	110	108	108
North West	96	96	95	95	96	95	94	93	92	92	92	92	92	92	93	95	96	97	97	98	99	100	100	100	100
East of England	103	103	104	104	103	103	102	101	100	101	101	102	102	103	103	102	102	102	101	101	100	100	99	99	99
Scotland	96	95	95	95	96	97	99	100	100	99	98	97	96	95	95	94	93	92	92	92	92	92	92	92	91
West Midlands	96	96	96	96	95	95	95	95	94	94	94	95	95	95	95	96	97	97	96	96	96	96	97	98	98
South West	99	99	99	99	99	99	99	100	101	102	103	102	103	103	102	102	103	103	103	103	103	103	101	100	100
Scotland	96	95	95	95	96	97	99	100	100	99	98	97	96	95	95	94	93	92	92	92	92	92	92	92	91
North East	95	94	95	95	96	97	98	97	96	95	95	94	94	95	96	96	95	94	93	92	92	91	90	90	89

Source: BCIS