Heathrow Benchmark Report

Prepared by

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1. Executive Summary

This Benchmark Report provides an independent, evidence based assessment of the cost efficiency of Heathrow Airport's major capital projects relative to international peers. Using Reference Class Forecasting (RCF), the analysis positions Heathrow's terminals, runways, baggage systems, and car parks within global cost distributions of comparable assets, all normalised to 2024 GBP PPP.

Across all asset types, Heathrow projects consistently lie above the international median, and in many cases fall within the upper quartile or even the upper decile of global benchmarks. This pattern is persistent across metrics and asset classes, indicating a systematic cost premium rather than isolated outliers.

Key findings include:

- **Terminals**: High cost outturns across all metrics (£/m^2, £/gate, £/passenger). Heathrow's Terminal 2 and Terminal 5 typically sit between the 60th and 90th percentiles of international benchmarks.
- **Baggage Handling Systems**: Extreme outliers above the 95th percentile, with unit costs up to twenty times higher than other UK systems operating in the same cost environment.
- **Runways and Airfield Works**: Exceptionally high costs exceeding the 95th percentile, even under narrow scope definitions, with unit costs per metre far above international norms.
- **Car Parks (MSCP4)**: A marked cost escalation from below-median values during Q6 to close to the 90th percentile in the current forecast, reflecting sustained growth in capital intensity.

Taken together, the benchmarking evidence points to three overarching conclusions. First, a structural cost premium is evident. Heathrow's capital delivery framework consistently yields higher costs than comparable international airports, even after controlling for scope, context, and price level. Second, scale does not translate into efficiency. Larger projects do not deliver proportional cost savings, indicating that potential economies of scale are not being realised. Third, consistently high costs across asset types point to governance, procurement, and ex-ante cost assurance as key influences. Design ambition alone does not explain the persistence of Heathrow's cost premium, which appears driven by broader features of project planning and delivery.

2. Introduction

2.1. Background and Context

Heathrow Airport is the United Kingdom's primary international gateway and its only true hub airport. It handles over 80 million passengers annually and connects to more than 200 global destinations, supporting over £200 billion of UK trade each year. Heathrow's role extends beyond transport infrastructure, it is a core national asset underpinning long-haul connectivity, economic productivity, and regional employment.

In preparation for the next regulatory period (H8, 2027–2031), Heathrow Airport Limited (HAL) has set out an investment programme totalling around £10 billion in 2024 prices. The plan is intended to address ageing assets, improve resilience, and increase capacity within the existing two-runway system. Key elements include the replacement and upgrade of baggage systems, a programme of selective upgrades and asset renewals across Terminals 3 and 4, optimisation of Terminal 5, and a range of safety, decarbonisation, and digital initiatives.

Against this backdrop, Heathrow Reimagined has called for an independent benchmarking analysis to provide transparent, data-driven evidence on how Heathrow's investment costs compare internationally and whether the airport's expenditure levels are proportionate to its scope and complexity.

2.2. Motivation for Independent Benchmarking

The Civil Aviation Authority's regulatory model links allowable charges to Heathrow's Regulatory Asset Base (RAB). This framework has been criticised for creating incentives that reward higher capital spending rather than efficient delivery. As a result, the credibility of benchmark studies used to justify future investment levels is of critical importance, not only for determining passenger charges but also for ensuring consumer protection and regulatory legitimacy.

The Interim Critique Report, delivered by Oxford Global Projects (OGP), highlighted several methodological weaknesses in HAL's commissioned benchmarking work:

- Lack of transparency in cost normalisation and inflation adjustments;
- Inconsistent or circular application of location and site-constraint uplifts;
- Mixing of estimated and outturn data without optimism-bias correction;
- Absence of percentile-based benchmarking or reference-class validation; and

- Insufficient testing of economies of scale and scope complexity.

This Benchmark Report builds on that critique by replacing selective and methodologically flawed comparisons with reproducible and statistically grounded Reference Class Forecasting benchmarks. The analysis uses OGP's global infrastructure database to position Heathrow's terminal, runway, baggage and car park projects within the wider cost distribution of comparable assets worldwide, after normalising all costs to 2024 GBP PPP.

2.3. Objectives of the Benchmarking Report

The primary objectives of this Benchmark Report are to:

1. **Provide an independent, transparent comparison** of Heathrow's capital projects against international benchmarks for similar airport assets.
2. **Quantify Heathrow's cost position** within global reference-class distributions, using percentile placement (P5–P95) for unit-cost metrics such as cost per m^2, per passenger capacity, per gate, and per baggage-throughput.
3. **Demonstrate methodological robustness** through clear normalisation steps and documentation of data sources.
4. **Explore limited scale effects** using regression-based elasticity estimates to determine whether Heathrow's project sizes generate either cost savings or cost penalties.

The report does not seek to identify causal cost drivers. Instead, it provides an empirically grounded view of Heathrow's position within the international cost landscape. This serves as a necessary input to ongoing regulatory and policy discussions concerning the efficiency of the H8 investment programme.

3. Methodological Framework: Reference Class Forecasting

3.1. Concept and Purpose

Reference Class Forecasting (RCF) is a data-driven benchmarking method used to assess whether the cost of a project is typical, low or high when compared with similar, completed projects worldwide. Rather than relying solely on bottom-up engineering estimates, it draws on observed outturn data to determine how a project sits within the actual performance distribution of its peers. Using realised costs is also essential, because early stage estimates often understate final outcomes due to optimism bias and incomplete scope definition. This provides a more reliable basis for assessing delivery performance.

The method originated from research by Kahneman and Tversky on optimism bias and has since been adopted in HM Treasury's *Green Book* and by several leading infrastructure regulators. It provides a statistical foundation for comparing project estimates or outturns with historical evidence, anchoring expectations in empirical performance rather than assumptions.[1]

In this study, RCF is applied not as a forecasting tool for future overruns, but as a benchmarking instrument for evaluating normalised unit costs. The aim is to place each project within an empirically derived cost distribution of comparable international assets, and to show its position in percentile terms. Similar benchmarking applications of Reference Class Forecasting have been used by several major public bodies, including the UK National Infrastructure Commission, HM Treasury, the New Zealand Infrastructure Commission and the Brazilian Federal Court of Accounts.

3.2. Definition of a Reference Class

Each reference class comprises a group of comparable projects drawn from the Oxford Global Projects (OGP) Database. Projects are selected to ensure that design scope, technical content, and functional purpose align closely with the Heathrow asset being benchmarked. Four principal reference classes are used:

1. **Airport Terminals** – Measured by cost per m^2, cost per passenger capacity, and cost per gate. Includes new terminals, major extensions, and refurbishments at hub and non-hub airports.
2. **Runways and Airfields** – Measured by cost per m^2 and cost per linear m, covering new construction and major extensions with similar pavement and lighting scope.
3. **Baggage Handling Systems (BHS)** – Measured by cost per throughput (bags per hour) for integrated or stand-alone systems.
4. **Car Parks** – Measured by cost per car space for surface and multi-storey parking associated with terminal developments.

[1] Reference class forecasting is discussed in HM Treasury's *Green Book* under Chapter 5, Section 5.6 on uncertainty, risk and optimism bias, and in Annex A5 on optimism bias and risk adjustments. Related approaches are also used by the UK Department for Transport, the Infrastructure and Projects Authority, the Dutch Rijkswaterstaat and the Norwegian Public Roads Administration, all of which apply outturn-based benchmarks to strengthen appraisal, oversight and risk adjustment.

For terminal projects, sub-classes are defined to distinguish between new airports, new terminals at existing airports, terminal expansions and terminal refurbishments. This ensures that each project is compared with an appropriate peer group.

3.3. Constructing and Interpreting the Benchmark Cost Curve

The Benchmark Cost Curve is the statistical backbone of Reference Class Forecasting. For every asset class, the individual projects are first normalised to 2024 GBP PPP using World Bank purchasing-power-parity indices and national GDP deflators. Each project's unit cost is then ordered from lowest to highest, creating a cumulative distribution of outcomes. The resulting curve shows, on the horizontal axis, the cumulative percentage of projects in the reference class and, on the vertical axis, their corresponding normalised unit cost.

Figure 1 illustrates the form of such a curve. Each point represents one project's position within the sample. The line climbs gently through the middle percentiles and steepens towards the upper tail, reflecting the typical pattern observed in real-world cost data: Most projects cluster around the centre of the distribution, while a smaller group record much higher costs. These elevated values may reflect ambitious specifications or weaknesses in delivery.

The P50 position, shown in red on the curve, represents the median benchmark: the point at which half of all projects were cheaper and half were more expensive. The P80 position represents the upper benchmark, meaning that four in five comparable projects were delivered at lower unit cost. Projects lying near this upper segment can therefore be characterised as high-cost relative to the reference class.

Conversely, the lower end of the curve represents the most cost-efficient schemes: projects that deliver the required functionality at comparatively modest cost. Interpreting the benchmark in percentile terms offers a probabilistic view of performance. The percentile indicates the likelihood that a random project in the sample would cost less than the one being evaluated.

Figure 1: Illustrative Benchmark Cost Distribution (Reference Class Forecasting)

Note: The figure shows a stylised benchmark cost distribution. The x-axis represents the cumulative percentile of projects in the reference class, and the y-axis shows their unit cost. The P50 line marks the median, while the P80 (P20) line identifies the cost range beyond which only 20 percent of projects are more (less) expensive.

3.5. Data Sources and Treatment

The analysis combines Heathrow project data with OGP's international reference classes comprising more than one hundred airport projects completed between 1995 and 2024. Sources include OGP's internal data repository, published airport accounts and regulatory filings, construction cost databases and project information supplied directly by Heathrow Airport Limited.

To harmonise these diverse data, a structured cleaning and normalisation process was applied:

1. **Extraction and validation:** For each project, cost, completion year, and scope variables (area, capacity, gates, throughput) were compiled and checked for completeness.
2. **Currency parsing:** Nominal values were separated into local currency and cost-year.
3. **PPP conversion:** All costs were converted to 2024 GBP PPP using World Bank purchasing-power-parity indices.

4. **Inflation normalisation:** GDP deflators were used to express all costs in 2024 price levels.
5. **Unit-cost computation:** Costs were divided by their physical scope measures to obtain consistent £-per-unit indicators.
6. **Outlier review:** Extremely high or low values were examined against original documentation to confirm validity.
7. **Sample verification:** The final datasets were reviewed to ensure a reasonable regional and temporal spread, although some reference classes, particularly for BHS, remain relatively small.

While reference classes vary in size, all contain sufficient diversity to support percentile-based benchmarking. Smaller samples, such as for BHS, are interpreted cautiously but remain directionally robust.

4. Data Normalisation

4.1. Purpose of Normalisation

To enable transparent comparison, all project costs in this study were converted to 2024 GBP PPP, that is, British pounds adjusted for purchasing-power parity and expressed in 2024 price levels. This ensures that Heathrow's costs and those of its international peers are evaluated as if they had all been incurred in the same economic context.

One could argue that, because the airport is located in the London region, an additional city level cost uplift should be applied to reflect local construction premiums. Although several commercial indices offer such adjustments, they differ in scope, method and underlying assumptions, and they are not designed for cross national statistical benchmarking. Reference class analysis requires a consistent and transparent basis for comparing costs across countries, which is why established practice relies on country level Purchasing Power Parity conversion. This is appropriate here because the objective is to assess relative international cost performance.[2] It enables fair comparison with global peers, including those located in other high cost metropolitan areas such as New York, Paris and Tokyo. Applying selective city level uplifts would weaken comparability and risk introducing systematic bias.

[2] In other contexts, for example in analyses of competition, consumer behaviour or retail market outcomes, direct comparisons of market prices may be more appropriate than using Purchasing Power Parity adjustments.

For the purpose of this study, country level Purchasing Power Parity adjustment remains the most coherent and transparent basis for comparison. It captures the dominant variation in construction input costs while maintaining consistency across all reference classes.

4.2. Overview of the Conversion Framework

The normalisation pipeline follows three sequential steps, applied consistently to Heathrow projects and international peers:

1. **Market FX → Local currency (at the cost year).**

   Reported costs first sit in the project's local currency. If the source is in another currency (e.g., USD or EUR), we convert to the project's domestic currency using market exchange rates for the cost year. This ensures the cost is anchored in the economy where inputs were purchased.

2. **PPP conversion: local currency → GBP at UK price level (same year).**

   We then translate local costs into GBP using country-specific PPP rates (local currency per £1). This moves the figure from the local price level to the UK price level, still at the original cost year.

3. **Rebasing to 2024 using UK inflation.**

   Finally, we inflate the PPP-adjusted GBP value to 2024 prices with the UK GDP deflator, putting every project onto a common price base.

$$\boldsymbol{Cost}_{\mathbf{2024}\ \boldsymbol{GBP\ PPP}} = \underbrace{\boldsymbol{Cost}_{local,year}}_{via\ market\ FX\ if\ needed} \div \underbrace{\boldsymbol{PPP}_{lcu\ per\ £}}_{same\ year} \times \underbrace{\frac{\boldsymbol{UK\ Deflator}_{2024}}{\boldsymbol{UK\ Deflator}_{year}}}_{rebase\ to\ 2024}$$

This order preserves economic meaning: market FX reconstructs the local spend; PPP aligns the price level with the UK; the UK deflator harmonises the time base.

4.3. Sources and Parameters

- **Market FX:** annual average rates from the World Bank, applied to the cost year reported for each project. The cost year is usually the year to which the original source has already inflation adjusted the outturn cost, often the completion year but sometimes an adjusted year provided for consistency.

- **PPP rates:** World Bank purchasing-power parity, interpreted as local currency per £1 for the same year as the cost observation.

  UK inflation: UK GDP deflator index with 2024 as the reference year.[3]

5. Dataset Overview

5.1. Composition and Scope

The Heathrow benchmark database consolidates data from two complementary sources:

1. OGP's international reference dataset, drawn from OGP's database, contains verified information on terminals, runways, baggage systems, and car parks from completed projects around the world.
2. Heathrow-specific data, supplied by HAL, set out the key parameters of the Heathrow projects that are positioned on each reference-class distribution (Terminal 2, Terminal 5, baggage handling systems, car parks, and the third runway concept).

In total, the combined dataset covers over one hundred international airport projects completed between 1995 and 2024. Each record includes estimated and outturn costs, cost year and currency, scope metrics (floor area, gates, passenger capacity, baggage throughput, or parking spaces), and location variables. All costs were converted to 2024 GBP PPP following the methodology in Section 4.

This structure allows Heathrow's project costs to be directly compared with a statistically valid distribution of international peers for each asset type.

5.2. Asset Class Coverage

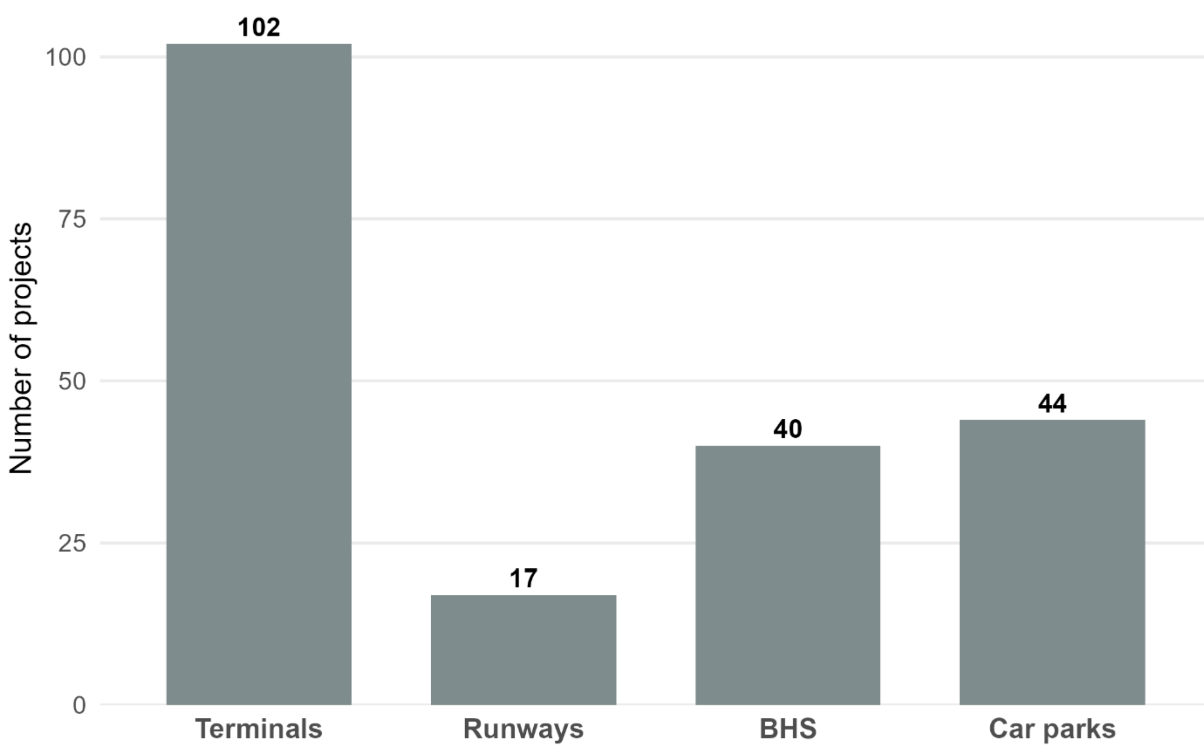
The benchmark sample includes four main asset categories, aligned with the Heathrow portfolio:

[3] 2024–2025 inflation assumed at 4%, reflecting current UK and OECD forecasts and the absence of published 2025 World Bank GDP deflators.

Asset Class	Description	Number of Projects	Unit Metric
Terminals	New terminals, expansions, and refurbishments	102	Cost per m^2 / per gate / per passenger capacity
Runways & Airfields	New and extended runways with associated taxiways	17	Cost per m^2, Cost per length (m)
Baggage Handling Systems (BHS)	Stand-alone and integrated baggage systems	40	Cost per hourly throughput
Car Parks	Surface and multi-storey car parks	44	Cost per car space

The distribution across asset classes is broad enough to construct credible percentile benchmarks. Terminal projects form the largest subset, providing strong statistical coverage for Heathrow's terminal overlays.

Figure 2: Distribution of Projects by Asset Type

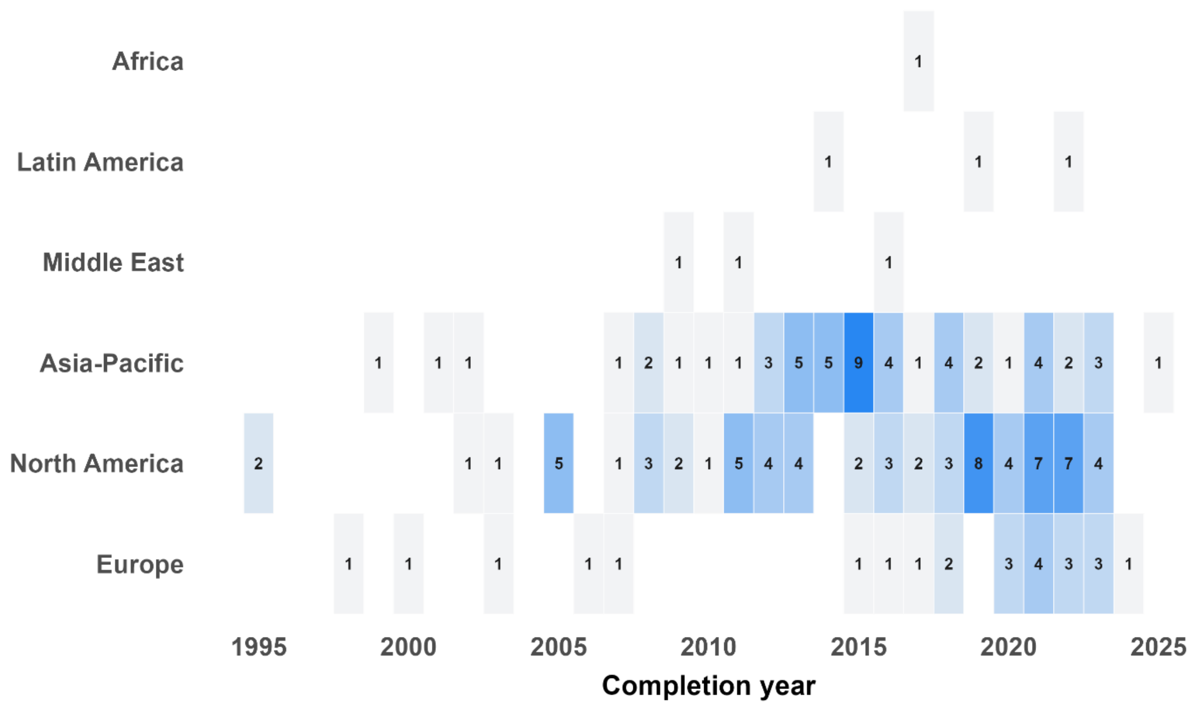


5.3. Geographic and Temporal Distribution

Projects in the benchmark dataset are geographically diverse, spanning 34 countries across all major regions. Europe, North America and Asia Pacific form the largest share and together account for about 80 per cent of the sample. The time coverage runs from projects completed in 1995 to those entering service in 2024 , which broadly aligns with the construction periods for Heathrow's T5 and T2.

To illustrate data representativeness, Figure 3 shows the number of projects by region and completion year.

Figure 3: Distribution of Projects by Region and Completion Year



5.4. Heathrow Projects Included in the Benchmark

The Heathrow portfolio analysed in this study includes the airport's major capital schemes that define its post-T5 development trajectory. Each project has been normalised to 2024 GBP PPP (see Section 4) and aligned with the relevant reference class from the international dataset. The projects span from completed assets such as **Terminal 2** and **Terminal 5** to planned or recently approved schemes including the **T2 and T3 Baggage Systems**, **MSCP4 car park**, and the **Third Runway concept**.

The table below summarises the key quantitative assumptions used for benchmarking.

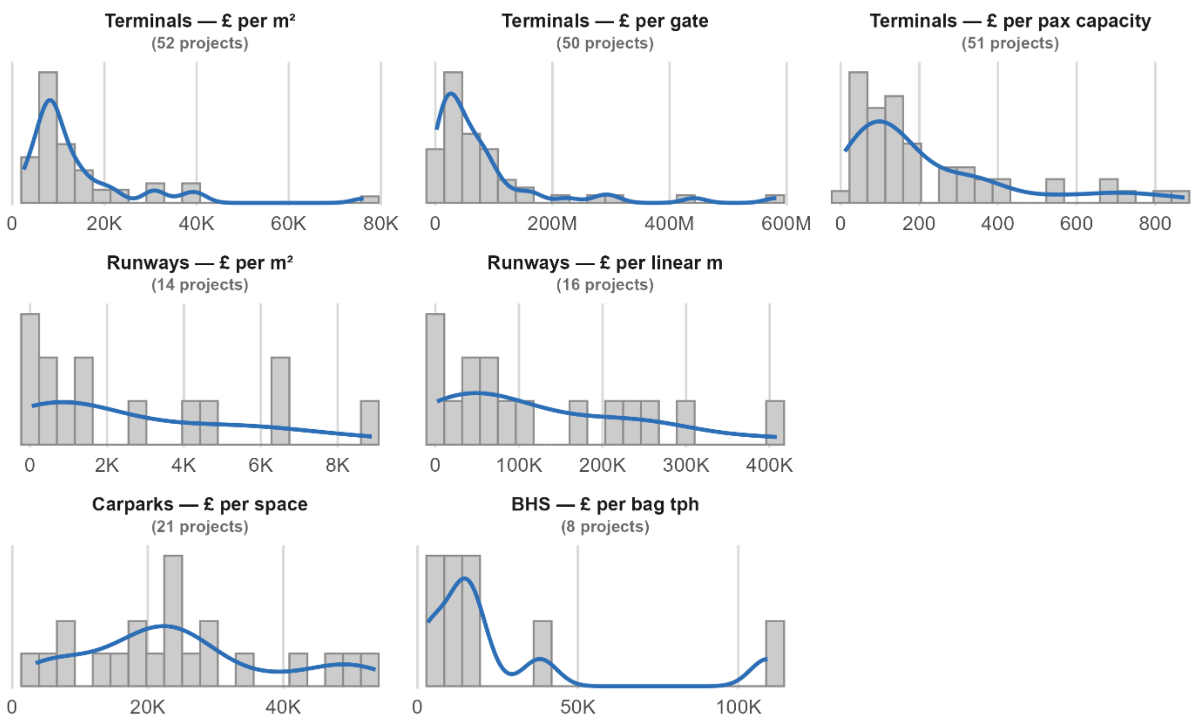
Asset Class / Project	Scope Summary	Stage / Estimate Point	Cost (£ M)	Cost Year
Terminal 2	incl. Satellite T2B • excl. T2 BHS • 210 000 m^2 • 41 gates • 20 m pax p.a.	Out-turn	2 500	2014
Terminal 5	incl. Satellite T5C • 353 000 m^2 • 55 gates • 30 m pax p.a.	Pre-construction / Planning	320	2000
		Main construction programme	4 300	2008
		Satellite T5C extension	346	2011
Terminal 2 Baggage System	2 000 bags/h capacity	P1 Initial Planning	✂✂✂	2022
		P2 Developed Estimate	✂✂✂	2023
		G3 Delivery Approval	✂✂✂	2025
		Current Programme Forecast[4]	✂✂✂	2025
Terminal 3 Baggage System	✂✂✂ bags/h capacity	Out-turn	500	2014
Terminal 5 Baggage System	✂✂✂ bags/h capacity	Out-turn	✂✂	2009
Multi-storey car park 4 (MSCP4)	880 spaces	Q6 Baseline (2014)	✂	2014
		Gateway 1 – Concept Approval	✂✂	2021
		Gateway 2 – Developed Design	✂✂	2022
		Gateway 2 – Update	✂✂	2023
		Current Forecast	✂✂	2025
Third Runway Concept (H8 Scenario)	210 000 m^2 (3 500 m × 60 m)	Full scope (incl. all overheads)	21 000	2023
		– excl. planning consent	✂✂✂✂	2023
		– excl. property acquisition	✂✂✂✂	2023
		– excl. site clearance	✂✂✂✂	2023
		– excl. platform construction	✂✂✂✂	2023
		– excl. earthworks	✂✂✂✂	2023

[4] Applies to T2 Baggage Programme, not only the system. Figure update to £884 million estimated in the Heathrow Investment Impact Report (2024)

5.5. Descriptive Statistics and Sample Properties

Figure 4 presents the empirical distributions of normalised unit costs across all reference classes. Each subplot combines a histogram of observed data with a kernel-density curve, showing the frequency and shape of cost outcomes once converted to 2024 GBP PPP. The curves illustrate the underlying cost heterogeneity within each asset category and help visualise where Heathrow's projects later fall within the same ranges.

Figure 4: Unit Cost Distributions by Asset Type



Note: Sample sizes differ from total project counts because only entries with complete unit cost data are included.

Airport terminal projects display the greatest dispersion of costs across all three measures: £ per m^2, £ per gate, and £ per passenger capacity. Each distribution is markedly right-skewed: a dense cluster of moderately priced projects lies below £ 15 000 per m^2 or around £ 200 million per gate, followed by a long upper tail extending to two or three times those values. This skewness reflects both the wide range of design quality and the influence of complex terminals projects similar in scale and specification to Heathrow's. Such variation confirms the need for percentile-based benchmarking rather than simple averages.

For runway projects, the distributions are flatter and less skewed, with most costs concentrated between £ 1 000 and £ 6 000 per m^2 or below £ 200 000 per linear metre. These relatively narrow ranges suggest that runways are more standardised assets, where local ground conditions and procurement models drive modest differences but economies of scale dominate.

Car-park investments form a roughly symmetric distribution centred around £ 25 000 to £ 30 000 per space. Variability here primarily arises from differences in structure type (multi-storey versus surface) and integration with terminal precincts.

Finally, baggage handling systems exhibit a bimodal distribution, with one cluster of relatively simple systems below £ 30 000 per bag tph, that is per unit of hourly baggage throughput capacity, and another above £ 90 000. However, the limited sample size warrants cautious interpretation.

5.6. Data Quality and Representativeness

Data completeness is highest for terminals and carparks, where both cost and scope metrics are generally available. Specialised systems such as the baggage handling systems have smaller sample sizes and higher cross-country variability. All cost values are total project out-turn costs and exclude financing, tax, or land-acquisition costs to maintain comparability.

Systematic checks were conducted to identify potential biases in the dataset:

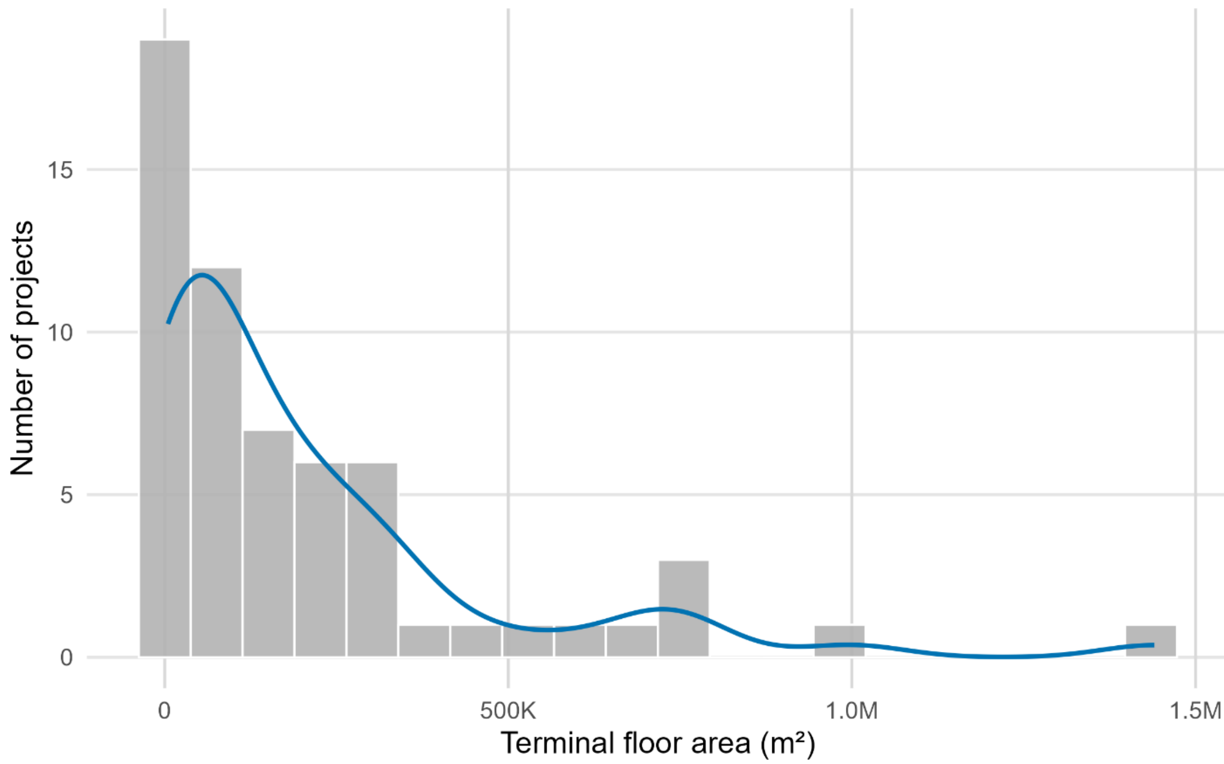
- **Temporal bias** is limited by inflation correction to 2024 GBP PPP.
- **Regional bias** persists slightly towards OECD economies, though comparable cost-structure data from emerging markets (e.g., Latin America, Middle East) are included where available.
- **Scope bias** was mitigated through classification refinements (e.g., distinguishing "terminal expansion" from "new terminal").

Figure 5 shows the distribution of terminal floor areas across the global benchmark sample. The histogram demonstrates that the dataset captures a wide and representative range of terminal sizes, from compact regional facilities to the world's largest hub complexes. Most terminals cluster below about 150 000 m^2, indicating that typical international projects are medium-sized facilities serving regional or national networks. The right-skewed shape of the distribution, however, reveals a meaningful upper tail: a smaller number of major hubs extend well beyond 500 000 m^2, with a few reaching or exceeding one million square metres.

The largest terminals in the sample include Istanbul International (≈ 1.44 million m^2), Madrid-Barajas T4 (≈ 1.0 million m^2), and Beijing Daxing (≈ 780 000 m^2), alongside other large-scale developments such as Mexico City's New Terminal, Hamad International in Doha, and Denver International. Together these projects anchor the high-capacity end of the benchmark and ensure that the reference class meaningfully covers the full global scale spectrum.

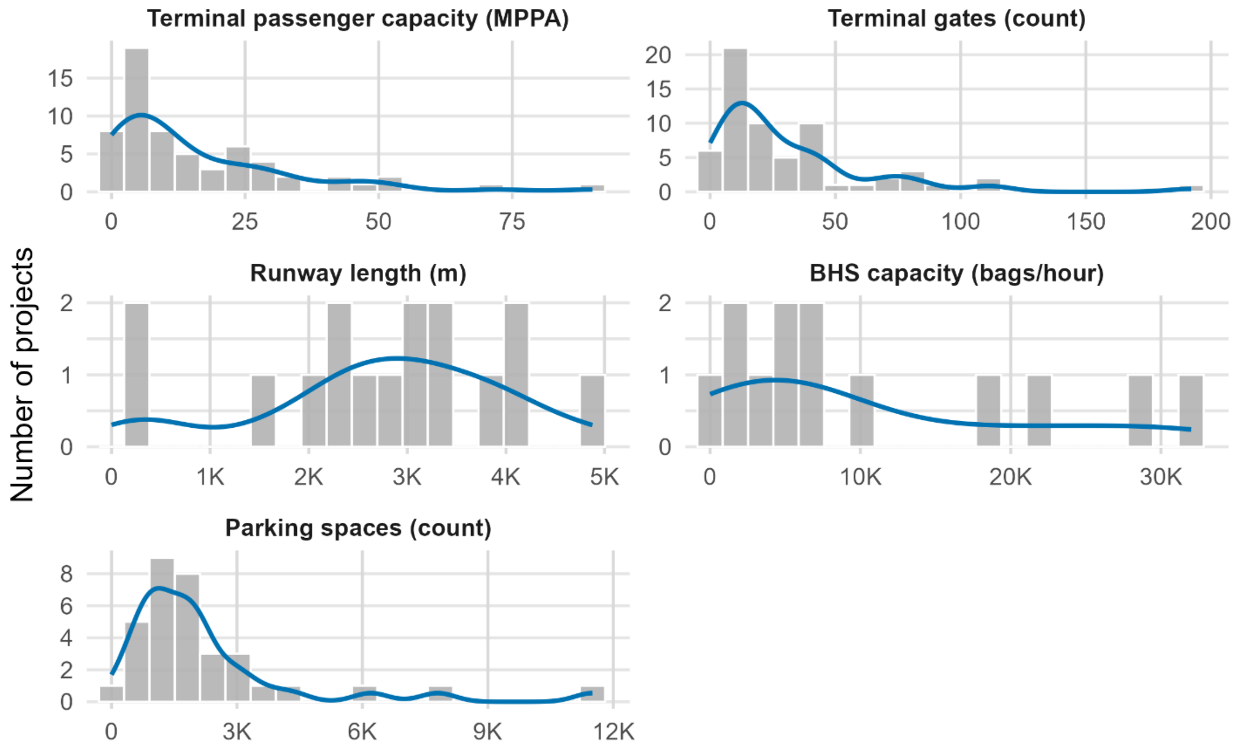
Within this context, Heathrow's Terminal 2 (≈ 210 000 m^2) and Terminal 5 (≈ 353 000 m^2) fall well above the median project size and sit comfortably within the upper quartile of the global sample. Their position confirms that Heathrow is benchmarked against genuinely comparable facilities rather than smaller regional airports, while still within a representative global range.

Figure 5: Histogram of Terminal Project Floor Areas (m^2)



Beyond floor area, the benchmark includes a broad range of terminal and airport-system metrics that capture overall capacity and functional scale (Figure 6). The distributions of passenger capacity, gate counts, runway length, baggage-system throughput, and parking spaces confirm that the dataset spans from compact regional airports to very large international hubs. As with floor area, most observations cluster toward the lower end, with long right-hand tails reflecting a smaller number of high-capacity, multi-terminal facilities. This ensures that the reference classes used for Heathrow benchmarking are representative across asset types while still encompassing projects of comparable magnitude. The presence of such large facilities also highlights an important analytical consideration developed later in this report: projects of Heathrow's scale should, in principle, benefit from economies of scale, translating size into cost efficiency rather than diseconomy.

Figure 6: Distributions of Airport Scope Metrics Across the Benchmark Sample



6. Benchmark Metrics and Validation

This section defines the benchmark metrics used in the Heathrow analysis and validates them empirically using the observed relationships between project cost and scope across the international reference classes. The goal is to demonstrate that the chosen metrics are statistically robust, mutually coherent, and representative of cost formation mechanisms in airport development.

6.1. Overview of Benchmark Metrics

The benchmark applies harmonised unit-cost indicators that relate each project's outturn cost to its physical or functional scale. The following table summarises the metrics used across asset types.

Asset Type	Metric (s)	Analytical Purpose
Terminal Buildings	Cost per m^2 (floor area); Cost per passenger capacity (MPPA); Cost per gate	Capture construction intensity, delivered capacity, and stand provision.
Runways	Cost per m^2 paved area; Cost per runway length (m)	Reflect geometric scale and specification of airfield works.
Baggage Handling Systems	Cost per throughput (bags per hour)	Measure automation and design standard.
Car Parks	Cost per parking space	Represent structure type and cost intensity.

Together these measures describe the physical and operational dimensions of investment efficiency and allow for transparent, like-for-like benchmarking of Heathrow's projects against global peers.

6.2. Empirical Validation of Metrics

To ensure that each metric behaves predictably and is suitable for cross-project benchmarking, OGP tested the statistical relationship between total project cost and its corresponding scope measure using Pearson correlations and log–log regressions across the full dataset. The results confirm that the main denominators, particularly terminal floor area and passenger capacity, are strong and consistent predictors of project cost.

Asset Type	Metric	N	Corr.	Significance	Interpretation
Terminals	Floor area (m^2)	52	0.90	<0.001	Very strong linear scaling; floor area reliably predicts cost.
	Passenger capacity (MPPA)	51	0.75	<0.001	High correlation between cost and throughput capacity.
	Gates (count)	50	0.73	<0.001	Consistent relationship between stand provision and total cost.
Runways	Runway length (m)	16	0.31	0.24	Limited predictive value; used as descriptive scale indicator.
	Paved area (m^2)	14	–0.06	0.84	No systematic bias; included for completeness.
Baggage Systems	Throughput (bags/hour)	8	0.70	0.05	Moderate positive relationship between capacity and cost.
Car Parks	Parking spaces (count)	21	0.75	<0.001	Strong and consistent size–cost relationship.

These findings confirm that cost variation across the dataset follows expected and stable patterns. For terminals, the relationship between cost and scale is particularly strong, supporting their use as a central benchmark category. The car park dataset also performs well, showing predictable size–cost behaviour across a range of typologies.

Although the baggage system sample is smaller (n = 8), the correlation remains statistically significant, indicating that throughput capacity is a meaningful predictor of system cost. This supports inclusion of BHS benchmarks, while recognising that results should be interpreted with the appropriate caution due to limited observations.

The runway data exhibit a weaker correlation, which is not unexpected. Runway costs depend heavily on site-specific conditions, design standards and regulatory environment. Total paved area also tends to vary with apron layout and taxiway integration, which can mask the relationship between cost and effective runway length. For this reason, runway length is retained as the preferred and most interpretable scale indicator, its explanatory power is modest but more consistent than alternative measures such as paved area, and it provides a stable basis for comparative benchmarking.

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7. Heathrow Benchmark Comparison

This section compares Heathrow's major capital projects, including terminal buildings, baggage handling systems, airfield works, and car parks, with international benchmarks drawn from OGP's global airport database. The analysis applies Reference Class Forecasting (RCF) to position each Heathrow project within the cumulative cost distribution of comparable assets delivered worldwide. All benchmarks are expressed as normalised unit costs in 2024 pounds sterling, with exchange rates, inflation, and purchasing power parity held constant. This ensures that each project is assessed as if delivered under the same economic conditions, allowing meaningful comparison across countries and time periods.

Benchmark positions are expressed in percentile terms. A P50 position corresponds to the global median, while a P90 position indicates that 90 percent of comparable projects were delivered at lower unit cost. Percentile rankings therefore provide a transparent and intuitive measure of relative cost efficiency, independent of absolute price levels.

Across all asset types and unit-cost metrics, Heathrow's projects consistently lie above the international median and frequently fall within the upper quartile or upper decile of the global distribution. This finding holds not only for historic outturns but also for current forecast positions where applicable.

To test whether Heathrow's apparent cost premium is driven by sample composition or contextual factors, the analysis also considers narrower reference classes that control more tightly for project type, scale, and delivery context. Heathrow's projects remain at the higher end of the cost distribution under these more restrictive comparisons.

A small number of international projects exceed Heathrow on individual metrics. These cases are typically associated with clearly identifiable characteristics, such as exceptional architectural ambition, unusually high technical or resilience requirements, or atypical site conditions. By contrast, Heathrow's projects tend to sit above the benchmark across multiple asset types and metrics, suggesting a more systematic pattern rather than isolated, project-specific effects.

Overall, the benchmark comparison shows that Heathrow's capital programme exhibits a persistent and broad-based cost premium relative to international comparators.

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7.2. Terminal Buildings

Terminal development has historically formed the cornerstone of Heathrow's capital programme, with major projects such as Terminal 2 and Terminal 5[5] serving as key drivers of the airport's Regulatory Asset Base (RAB). Looking ahead, the Modernising Heathrow initiative, which aims to replace the ageing Terminal 3 by the 2040s, is expected to require investment of around fifteen billion pounds, equivalent to roughly three quarters of the current RAB. In the nearer term, the H8 capital programme of ten billion pounds is concentrated on the Resilience portfolio, which accounts for about £4.5 to £5.5 billion pounds and focuses on the renewal and enhancement of existing terminal and airfield infrastructure.

Several terminal projects in the global sample exceed Heathrow on individual unit-cost metrics. These cases typically reflect structurally different conditions, including very high space provision per passenger, small passenger bases over which fixed costs are spread, or exceptional technical or architectural specification.

Three complementary metrics are used to benchmark the cost efficiency of terminal projects: cost per square metre, cost per gate, and cost per passenger capacity. Each captures a different dimension of terminal design and delivery, namely construction intensity, stand provision and throughput. Across all three indicators, the results are consistent: Heathrow's terminals sit at the upper end of the international cost distribution.

7.2.1. Cost per Square Metre

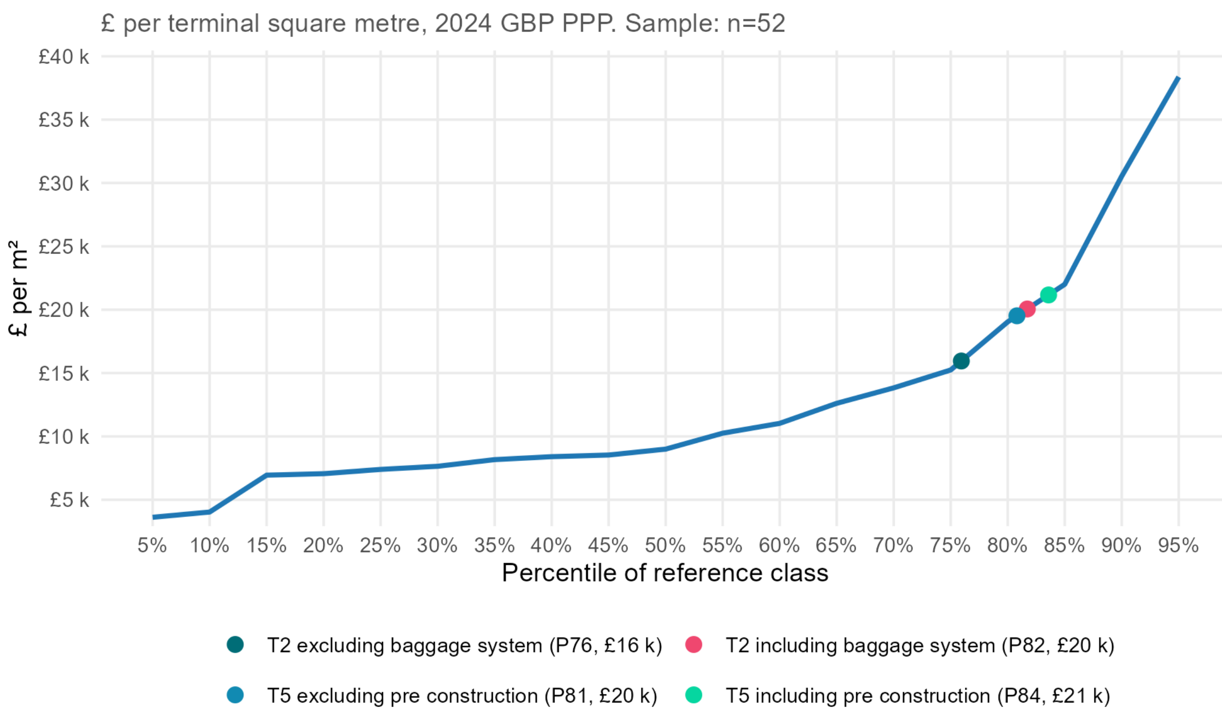
Figure 7 presents the reference class of 52 terminal projects. With all major elements of scope included, Terminal 2 lies around the 82nd percentile at about £20,000 per square metre, while Terminal 5 lies at the 84th percentiles at about £21,000 per square metre.

For transparency, a value for Terminal 2 that excludes the baggage system is also shown. This lowers its reported cost slightly, but does not shift its relative position materially; it remains well above the benchmark median. In other words, whether baggage is included or excluded, the terminal continues to occupy high cost positions relative to their international peers. For Terminal 5, results are shown both with and without pre-construction costs. The difference is modest, and in both cases the project remains in the upper region of the international distribution.

[5] Terminal 2 was delivered without a dedicated baggage handling system, and Terminal 5 includes separate reporting for pre-construction works and the T5C satellite. Terminal benchmarks therefore use full-scope costs for consistency, with the Terminal 2 baggage system cost based on the latest forecast.

These findings are reinforced by comparator terminals such as Madrid Barajas T4, Seoul Incheon T2 and Toronto Pearson T1, which deliver comparable architectural quality and complexity at costs closer to the median range.

Figure 7: Terminal Cost per m^2 – Reference-Class Distribution (Global Sample)

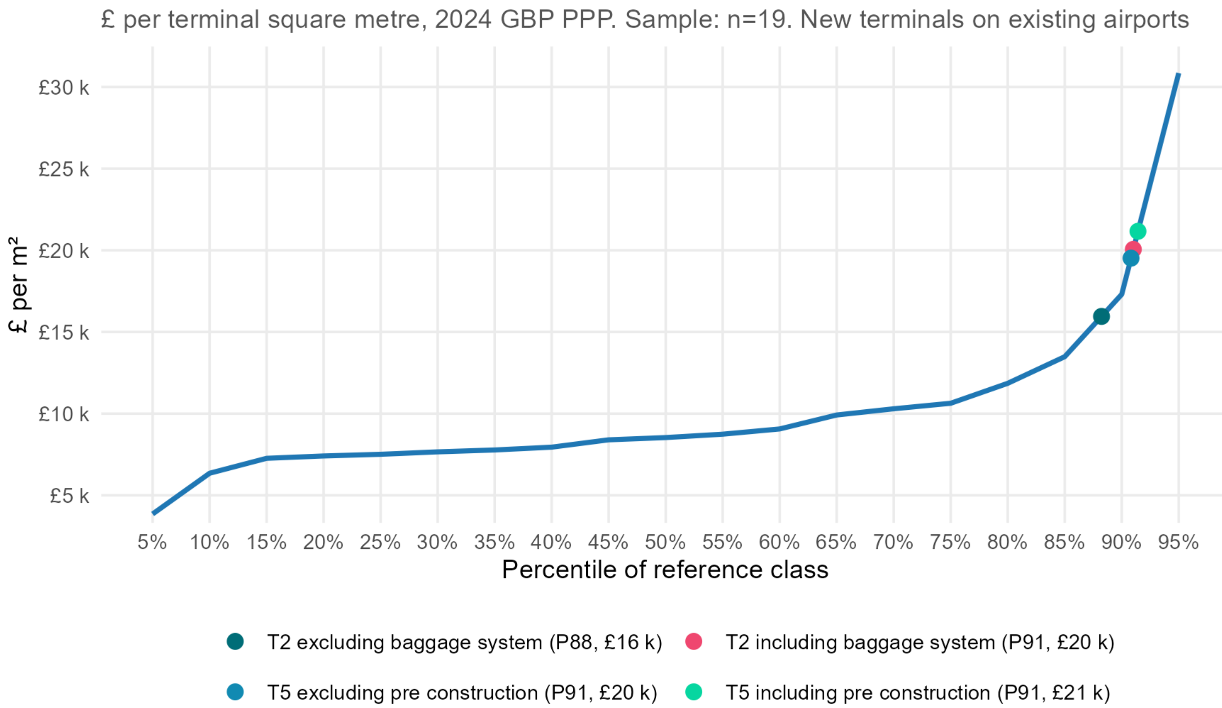


When the sample is restricted to new terminals built on existing airports (Figure 8; n = 19), which provides a more contextually relevant comparison group, Heathrow's relative cost position rises further. Both, Terminal 2 and 5 move to around the 91st percentile, meaning that roughly nine out of ten comparable projects delivered at lower unit cost.

This subset includes large brownfield developments such as Madrid Barajas T4, Toronto Pearson T1, Seoul Incheon T2, Istanbul Sabiha Gokcen and Salt Lake City, as well as a range of mid sized international terminals, including Melbourne T4, Dallas D, Raleigh Durham T2 and Bilbao. These examples are broadly comparable in size and operational complexity. They combine expansion within active airport sites with the need to maintain passenger operations, conditions that are similar to those faced in Heathrow's delivery environment.

Although the smaller dataset introduces greater statistical uncertainty, its contextual closeness reinforces the interpretation that Heathrow's terminals are structurally high-cost outliers, even among projects that share equivalent interface constraints, brownfield phasing, and service continuity requirements.

Figure 8: Terminal Cost per m² – Reference-Class Distribution (Existing Airports Subset)

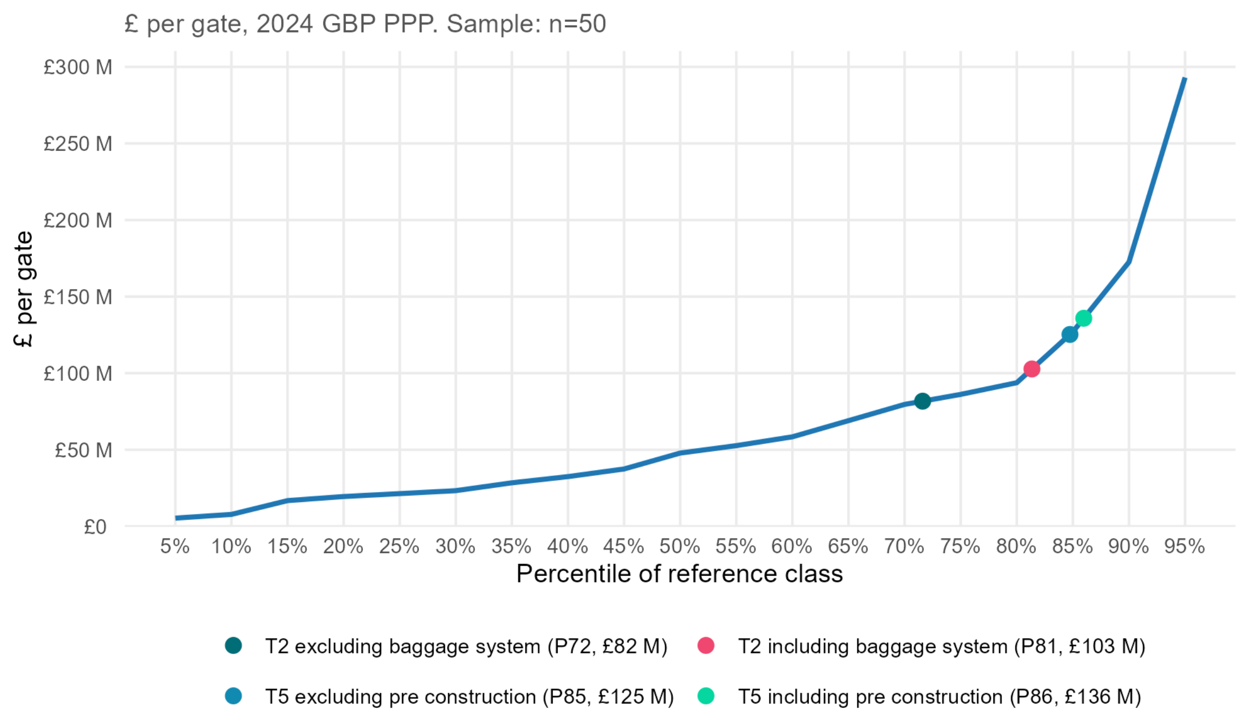


7.2.2. Cost per Gate

A similar pattern emerges when benchmarking cost per gate (Figure 9 and Figure 10). Terminal 2 delivers at about £103 million per gate, corresponding to the 81st percentiles, while Terminal 5 delivers at about £136 million per gate, placing it at the 90th percentiles.

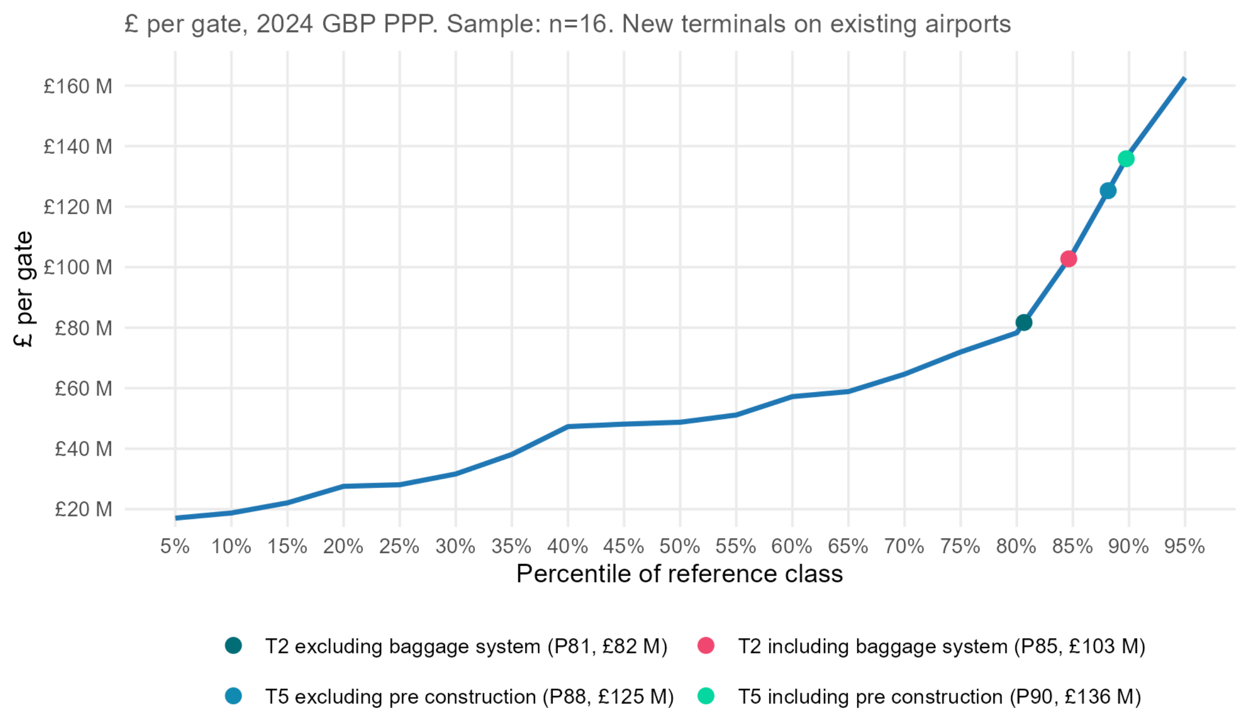
Values that exclude the Terminal 2 baggage system or exclude pre construction expenditure for Terminal 5 lower the unit costs slightly, but they do not alter the overall interpretation. In each case, the terminals remain in the upper quartile of the global distribution.

Figure 9: Terminal Cost per Gate – Reference-Class Distribution (Global Sample)



Within the subset of new terminals built on existing airports, which provides the most relevant comparison group, the relative positions rise further. Heathrow's terminals still exceed the costs of other complex hub expansions such as Madrid T4, Seoul Incheon T2 and Toronto Pearson T1, all of which sit closer to the centre of the benchmark distribution despite facing comparable operating and interface constraints.

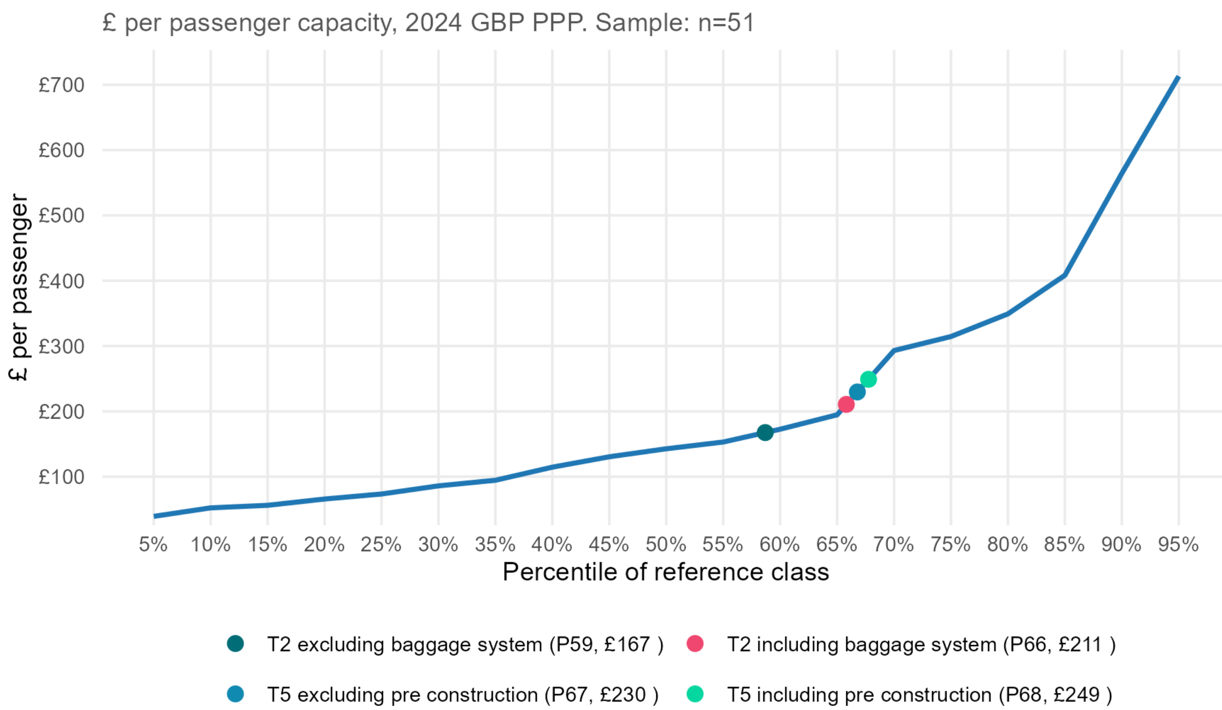
Figure 10: Terminal Cost per Gate – Reference-Class Distribution (Existing Airports Subset)



7.2.3. Cost per Passenger Capacity

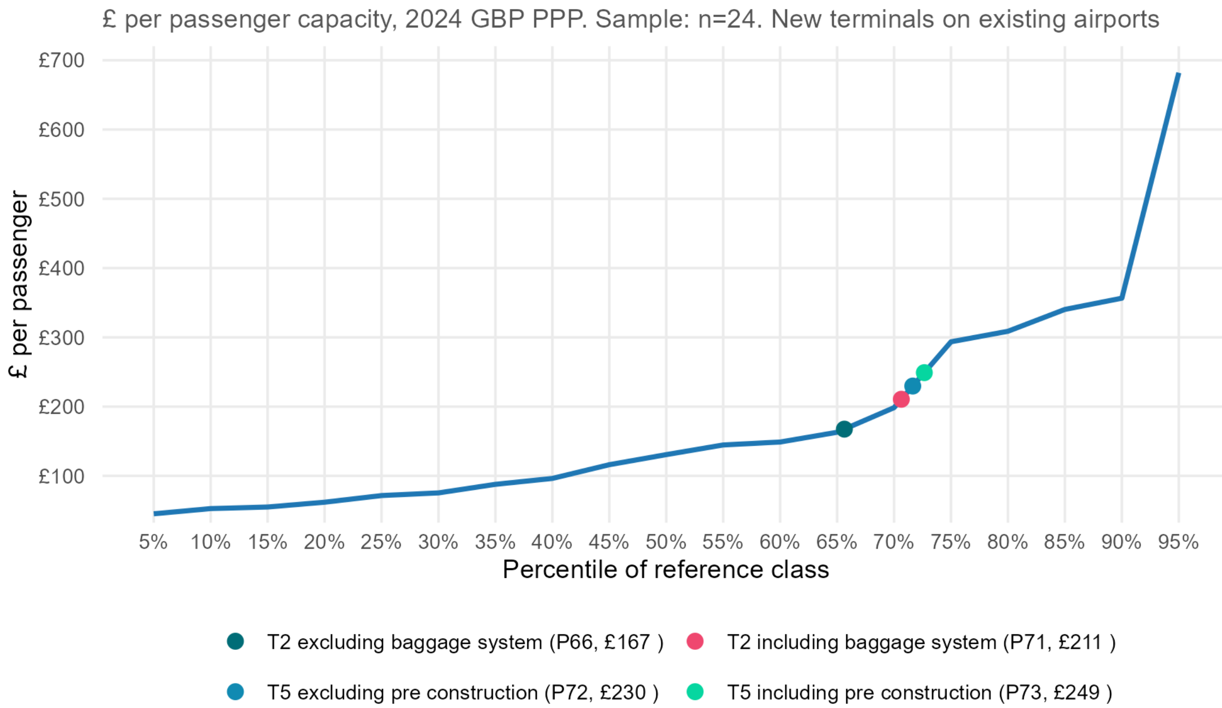
Passenger capacity benchmarks (Figures 11 and 12) position Heathrow somewhat closer to the centre of the global cost distribution, though still clearly on the upper side. In the full reference class (*n = 51*), Terminal 2 delivers at approximately £211 per annual passenger capacity (P66), while Terminal 5 sits at £249 per passenger (P73). These values place Heathrow's terminals within the upper middle segment of the international sample, less extreme than in area-based or gate-based comparisons, yet consistently above the benchmark median. Even when the scope excludes the baggage system for Terminal 2 and the enabling works for Terminal 5, the shifts in their relative positions are modest. Terminal 2 moves to P59 and Terminal 5 to P67, both still indicating comparatively high capital intensity.

Figure 11: Terminal Cost per Passenger – Reference-Class Distribution (Global Sample)



The smaller but more contextually relevant subset of new terminals on existing airports (Figure 12; *n = 24*), both terminals move to higher percentile positions, and the effect is, if anything, more pronounced. This strengthens the overall interpretation that Heathrow's terminals exhibit comparatively high capital intensity.

Figure 12: Terminal Cost per Passenger – Reference-Class Distribution (Existing Airports Subset)



Conceptually, capacity-based metrics tend to favour large, high-throughput hubs, where economies of scale should lower unit costs per passenger. That Heathrow's terminals nonetheless remain above average on this measure suggests that size-related efficiencies are offset by higher design, integration, and delivery costs. While not as pronounced as the differences observed on a per-m^2 or per-gate basis, the pattern is consistent: Heathrow's terminals are delivered at a higher capital cost than comparable international projects.

Forward-looking regulatory evidence is consistent with this pattern. The CAA has cited an indicative estimate of around £6.8 billion for 22 million additional annual passengers from the Terminal 2 expansion, implying a cost of roughly £310 per passenger, which would also place this project toward the upper end of the reference class distribution.[6] Although this estimate is immature, its position reinforces the conclusion that future Heathrow terminal capacity is expected to remain capital intensive by international standards.

7.3. Baggage Handling Systems (BHS)

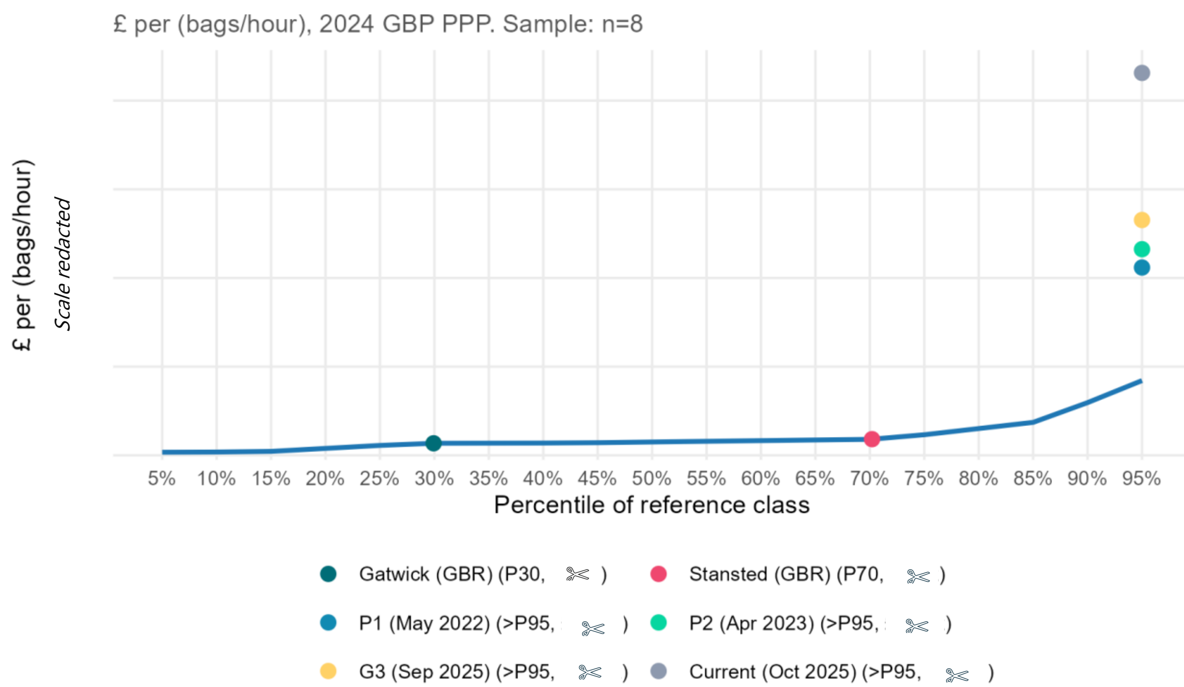
Figure 13 and

[6] Civil Aviation Authority (2022), Heathrow Airport Limited: H7 Initial Proposals, paragraph 2.60.

Figure 14 show the cost of baggage-handling systems (BHS), expressed in £ per bag/hour of design throughput. The benchmark sample is small (n = 8), but it is internally consistent and includes two London systems, Gatwick and Stansted, which share the same local cost base and therefore provide a strong basis for comparison.

Within this limited dataset, Heathrow's results stand out sharply. The ongoing T2 Baggage Programme, shown in Figure 13, ranges between £[redacted] and £430 000 per bag/hour across successive milestones (P1 → G3 → Current), maintaining a position well above the 95th percentile in every case.

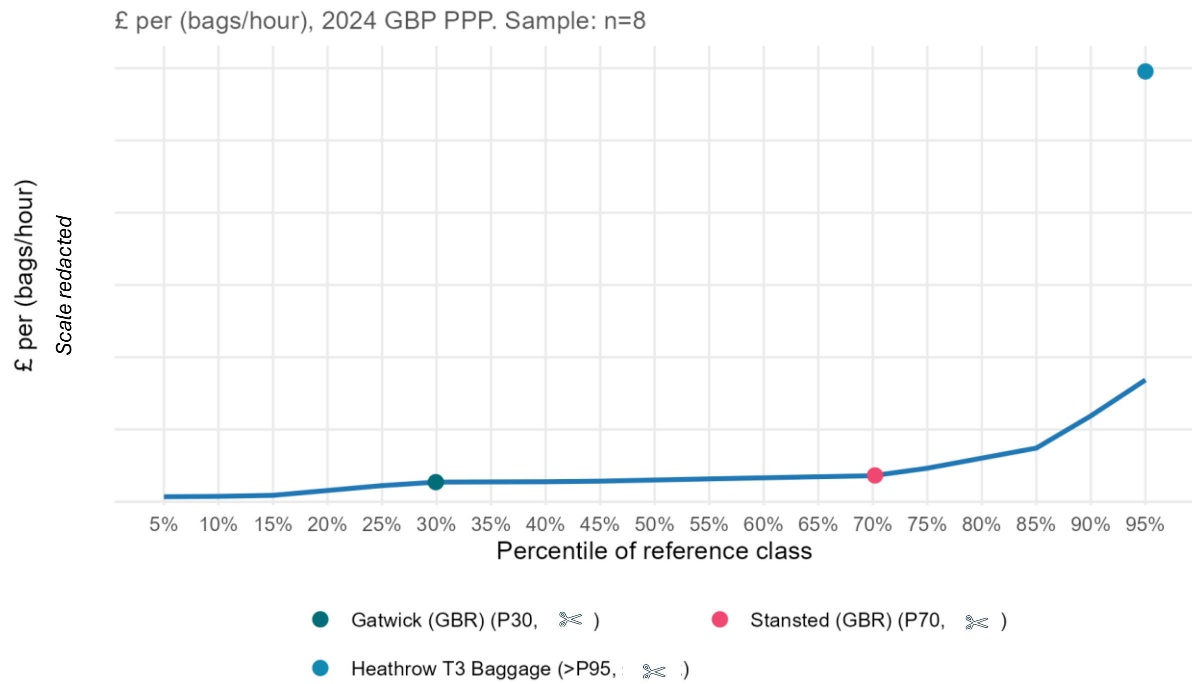
Figure 13: BHS Cost per Throughput – Reference-Class Distribution (Heathrow T2 Programme and UK Comparators)



The T3 baggage system, shown in

Figure 14, is just as extreme, with an estimated cost of roughly £✂✂ ✂per bag per hour, which is the highest value observed in the reference class.

Figure 14: BHS Cost per Throughput – Reference-Class Distribution (Heathrow T3 and UK Comparators)



By contrast, Gatwick (P30, £✂✂✂✂) and Stansted (P70, £✂✂✂✂) lie an order of magnitude lower on the cost scale.

The small sample size warrants some caution in statistical interpretation, yet the inclusion of two domestic comparators mitigates this limitation. Because Heathrow, Gatwick and Stansted operate within the wider South East of England, the comparison holds key regional economic and regulatory conditions broadly constant. Hence, the analysis benefits from a form of natural control for local cost determinants, allowing observed differences to be attributed more directly to project-specific design and delivery factors rather than regional price variation. Even when compared with airports that face broadly similar regional cost conditions, Heathrow's unit costs remain ten to twenty times higher, reinforcing the extent of its outlier position.

Part of this premium can plausibly be attributed to Heathrow's unique design conditions: both the T2 and T5 baggage systems are located predominantly underground, requiring extensive excavation, tunnelling, and constrained construction interfaces beneath live terminal and airfield areas. However, the Stansted baggage system, which is also underground, offers an important point of reference, as its costs, at around P70, are far lower despite comparable subsurface constraints. This suggests that while underground construction and operational complexity explain part of Heathrow's premium, the magnitude of the observed difference still far exceeds the expected range. The evidence therefore points to Heathrow's baggage systems defining the upper tail of the global cost distribution, both in relative percentile terms and absolute cost per capacity unit.

7.4. Runways and Airfield Works

The figure below presents the reference-class distributions for airfield investments, expressed in normalised prices and shown on logarithmic scales. Because the physical configuration of runways differs greatly between airports, two complementary normalisations are used: cost per square metre and cost per linear metre. As established in Section 6, the latter correlates more strongly with total cost outcomes and is therefore considered the preferred indicator of scale efficiency. The benchmark sample consists predominantly of brownfield projects undertaken within operating airports, including new runways, extensions and major rehabilitations. Only one scheme in the list represents a genuine greenfield development. As a result, the reference class reflects delivery conditions that are broadly aligned with those faced in Heathrow's existing airfield environment.

Figure 15 shows the Third Runway benchmark on an area basis. Even the lowest scope definition, which reflects the runway asset alone, exceeds the 95th percentile of the global sample at roughly £✂✂ ✂✂✂per m^2. Including earthworks raises the estimate to about £✂✂ ✂✂ ✂ per m^2, and the full runway, earthworks and platform scope reaches approximately £✂✂ ✂✂ ✂ per m^2. These figures exclude any costs related to land acquisition. All values remain far above the median of international comparators once expressed at United Kingdom price levels, which indicates that the observed premium cannot be explained by geography or inflation.

Figure 15: Cost per runway area – Reference-Class Distribution (Third Runway Concept)

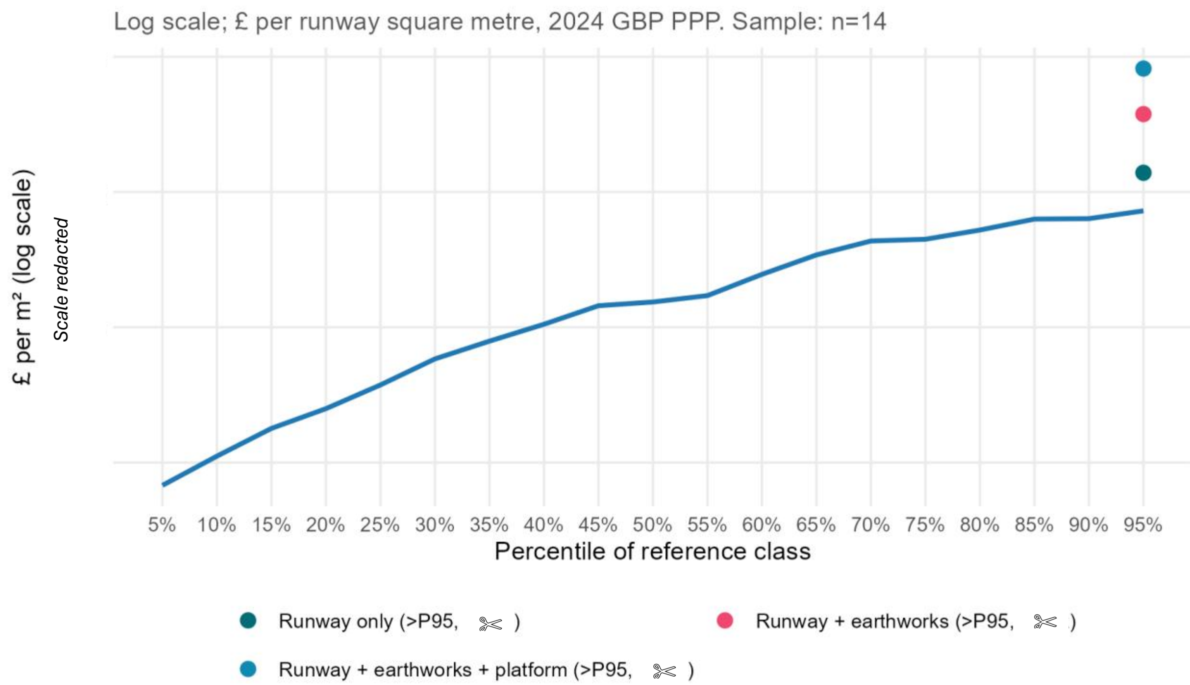
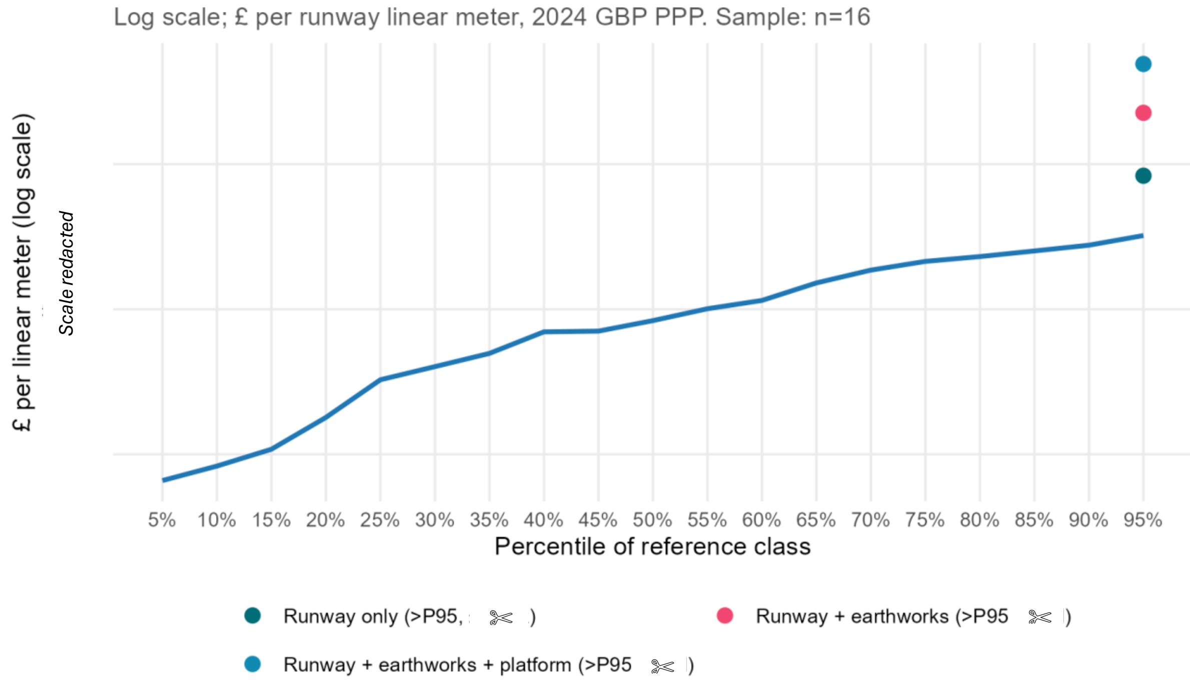


Figure 16 turns to the preferred metric, cost per linear metre, which provides a stronger predictor of runway construction cost. The results are consistent: the runway-only component already sits above P95 (≈ £✂million per metre), adding earthworks lifts the value to £✂ million per metre, and the comprehensive aggregation (incorporating runway, earthworks, and platform preparation) reaches approximately £✂ million per metre, all beyond the 95th percentile of the benchmark.

For comparison, most large international runways fall between £10 000 and £100 000 per linear metre, underscoring that Heathrow's cost is orders of magnitude higher than the global norm.

Figure 16: Cost per runway length – Reference-Class Distribution (Third Runway Concept)

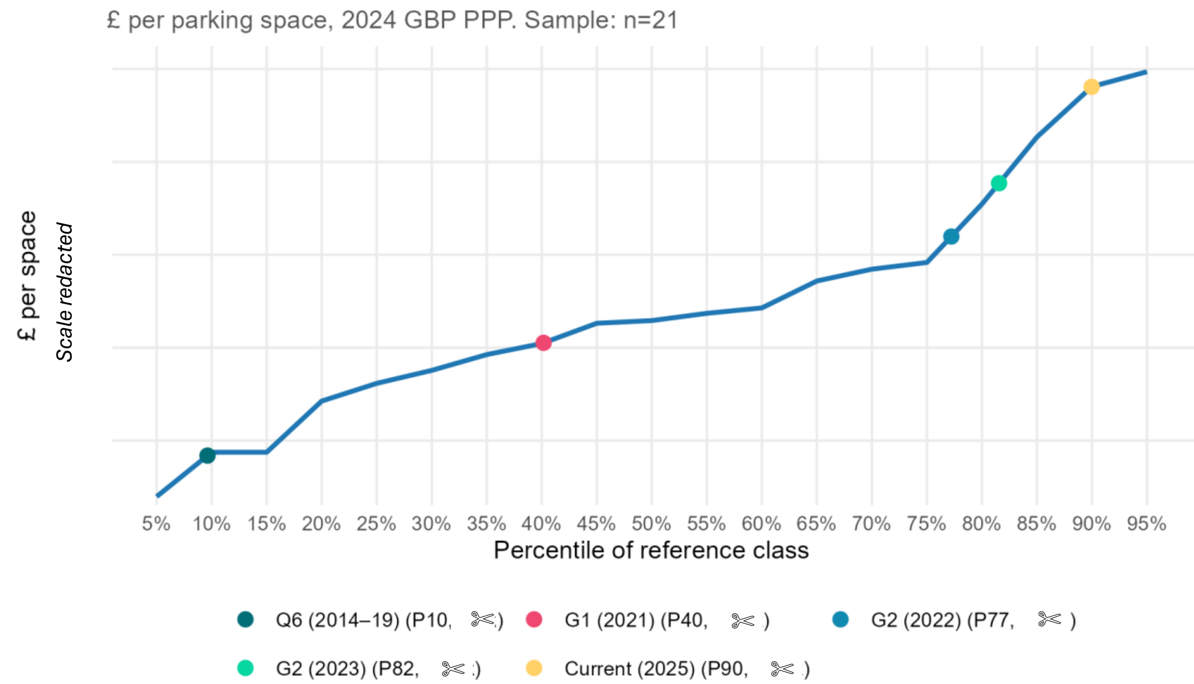


Together, the runway results reinforce Heathrow's overall benchmark profile: its capital projects are not isolated anomalies but consistently high-cost outturns across asset classes. Even when assessed using the metric most strongly correlated with cost, namely cost per linear metre, Heathrow remains above the 95th percentile, which confirms that its airfield investments are among the most expensive of their kind worldwide.

7.5. Car Parks

Car parks represent a smaller but still meaningful element of Heathrow's overall capital programme, providing an additional perspective on relative cost efficiency beyond terminals, airfields, and baggage handling systems. Figure 17 presents the reference-class distribution for car-park projects, expressed as £ per parking space in normalised prices. The Heathrow project shown here is the Multi Storey Car Park 4 (MSCP4). Its cost estimates have evolved across successive planning stages, starting with Q6 (2014–2019), followed by Gateway 1 (2021), Gateway 2 (2022–2023), and the current forecast for 2025.

Figure 17 Cost per car space – Reference-Class Distribution (MSCP4):



At the outset, the Q6 outturn delivered at roughly £[redacted] per space (P10), placing Heathrow well below the international median. By the G1 (2021) stage, the estimated unit cost had increased to £[redacted] per space (P40), aligning with typical multi-storey structures at major urban airports. The following G2 (2022–2023) estimates rose further to between £[redacted] and £[redacted] per space (P77–P82), and the current 2025 forecast for MSCP4 reaches £[redacted] per space (P90).

This steady escalation shows how Heathrow's car-park programme has moved from cost-efficient to upper-decile territory within a few planning cycles. Because all values are expressed in normalised prices, these differences cannot be attributed to inflation or exchange-rate shifts; they reflect real increases in construction intensity and design ambition.

The reference class (n = 21) covers a diverse set of surface, semi-covered, and multi-storey facilities across Europe, North America, and Asia, with most projects clustering between £10 000 and £30 000 per space. Against this backdrop, Heathrow's recent estimates stand out as distinctly higher, even after full normalisation to UK price levels. The MSCP4 trajectory encapsulates in miniature the broader pattern of high unit costs evident across Heathrow's portfolio. While early Q6 outturns aligned closely with the global median, later estimates display escalating capital intensity that mirrors the trends seen for terminals, runways, and baggage systems.

Taken together, these results indicate a systematic high-cost bias across Heathrow's capital programme. Its assets approach the 90th percentile of the international reference-class distribution, underscoring that Heathrow's delivery environment remains among the most expensive worldwide.

7.6. Cross-Asset Synthesis and Interpretation

Taken together, the terminal, baggage, runway, and car-park benchmarks reveal a coherent picture of Heathrow's cost performance. Across all asset types and normalisations, Heathrow's projects lie between the 75th and 95th percentiles of the international reference-class distributions.

For terminal buildings, the three complementary metrics (£ per m^2, £ per gate, £ per passenger) produce convergent evidence. Terminal 2 and Terminal 5 consistently occupy the P75–P90 range, indicating unit costs 30–70 % above the global median. Including integrated baggage systems or design-development expenditure moves both terminals into the upper-decile range.

Baggage-handling systems represent extreme outliers. Both the T2 and T3 programmes exceed the 95th percentile, with unit costs roughly an order of magnitude higher than other UK systems operating within the same labour and materials market. Local comparators at Gatwick and Stansted therefore provide a natural control: even under identical UK cost conditions, Heathrow's systems remain ten- to twenty-fold more expensive.

Runway and airfield works follow the same pattern. On both £ per m^2 and £ per linear-metre metrics, the Third Runway concept sits above P95. Even the lowest-scope configuration ("runway only") exceeds international medians by several orders of magnitude.

Finally, car-park investments illustrate how cost escalation has evolved over time. MSCP4 moved from an efficient Q6 out-turn (P10) to a current estimate near P90 within two planning cycles. Because all figures are expressed in normalised prices, this upward drift reflects real increases in design and construction intensity rather than macroeconomic effects.

Across these asset groups, three regularities stand out:

1. Heathrow's relative cost position remains high under every metric and scope definition.
2. Narrowing the benchmark to context-specific subsets (e.g., new terminals on existing airports) does not materially change the ranking.
3. The magnitude of the premium is too large to be explained by London market factors alone.

Importantly, a project does not need to be the most expensive on every individual metric to be among the most expensive programmes overall. Heathrow's cost position is characterised by consistently high outcomes across multiple asset types and benchmarks, rather than by a single extreme outlier. While a small number of international terminals exceed Heathrow on specific unit-cost measures, these cases are exceptional and structurally distinct. Heathrow's distinguishing feature is the extent and persistence of its cost premium across assets and metrics.

The cross-asset evidence therefore points to a structural rather than incidental phenomenon. Heathrow's delivery environment appears to embed higher capital intensity across asset types, offsetting the scale efficiencies typically observed at major hub airports.

7.7. Summary and Implications

The benchmarking analysis provides a comprehensive view of Heathrow's cost performance across its principal asset types. In every category examined, Heathrow's projects lie toward the upper end of the international reference-class distributions, even after adjusting for inflation, exchange rates, and purchasing power. The following table summarises the percentile positions and indicative cost magnitudes across assets.

Asset Type	Typical Percentile Position	Approx. Cost Relative to Median	Key Observation
Terminal Buildings	P75–P90	1.3–1.7×	High-cost outturns even in like-for-like brownfield contexts; costs rise further when including baggage systems or pre-construction scope.
Baggage Handling Systems	>P95	10–20×	Exceptional capital intensity; an order of magnitude above other UK comparators built under identical cost conditions.
Runways and Airfield Works	>P95	Several orders of magnitude higher	Extraordinary outturn costs across all scope definitions.
Car Parks (MSCP4)	P80–P90 (up from P10 historically)	3–6×	Cost escalation over successive planning stages, moving from below-median to upper-decile territory

Viewed collectively, these findings convey a systematic pattern of high cost intensity rather than a set of isolated anomalies. Heathrow's terminal projects consistently fall in the upper quartile or higher, its baggage systems and runways form the upper tail of their respective global distributions, and even car park facilities such as MSCP4 exhibit steep upward cost trajectories over time.

Because all values are expressed in normalised prices, the residual differences cannot be attributed to national price levels or exchange-rate effects. Nor can they be explained by the inclusion of pre-construction, enabling, or indirect costs. The evidence thus points to factors intrinsic to Heathrow's delivery environment as the primary sources of cost divergence.

8. Scale and Complexity Effects

Large infrastructure projects are generally expected to benefit from economies of scale: as size increases, total cost rises less than proportionally. A bigger terminal should not only cost more in absolute terms, but less per square metre because fixed design, management, and mobilisation costs are spread across more area. Heathrow's results, however, show the opposite. Its largest terminals remain among the most expensive worldwide, even after controlling for scale, scope and price level.

8.1. The Analytical Model

The following analysis quantifies how terminal cost changes with size using a log-log regression model estimated on the global airport sample:

$$\ln(y) = \alpha + \beta_1 \ln(size) + \beta_2 [\ln(size)]^2 + controls$$

where *y* is the actual terminal cost and *size* is the terminal's floor area in m^2. The squared term allows the fitted curve to bend, capturing either diminishing or increasing returns to scale. Control variables account for differences in cost year, project complexity, and project type (e.g., brownfield vs greenfield), ensuring that the relationship shown isolates the effect of scale itself, rather than inflation, scope, or sample composition.

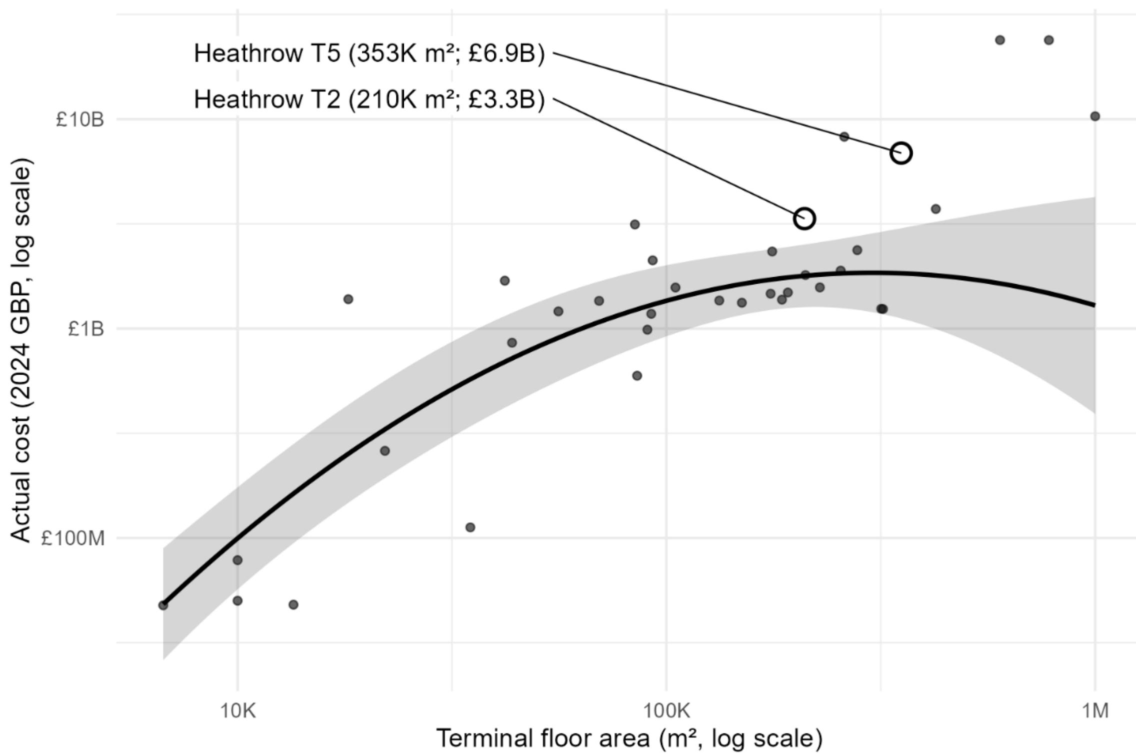
The log–log specification means that the regression coefficients describe elasticities, i.e., the percentage change in total cost associated with a 1 % change in terminal size.[7]

8.2. Fitted Cost Relationship

Figure 18 plots each terminal project's actual outturn cost against terminal size on logarithmic axes, together with the fitted regression curve and 95 percent confidence band. The fitted curve represents the expected cost of a terminal of a given size, based on average characteristics across the international sample. In effect, it shows what a project would be expected to cost if it followed the typical relationship between scale and expenditure observed globally.

[7] The fitted curve reflects an average global pattern rather than the specific context of large hub terminals like Heathrow. While some of the gap may reflect contextual differences, the fact that Heathrow remains above the curve after accounting for size and space provision shows that scale alone does not explain the cost premium.

Figure 18: Fitted Cost Curve: Terminal Size vs Actual Cost



The underlying regression model for terminal cost versus size is statistically significant (F-statistic = 17.8, $p < 0.001$) with an adjusted R^2 of 0.64, indicating that the model explains around two thirds of the observed variation in terminal costs across airports. Both ln(size) and $\ln(\text{size})^2$ are statistically significant at the 1 percent level, confirming a robust non-linear relationship between project scale and cost.

At first glance, the individual projects in Figure 18 appear to lie roughly along a straight line, which could suggest constant returns to scale. However, this visual impression reflects unadjusted outcomes that combine scale effects with substantial variation in project characteristics. The fitted curve does not simply trace the raw data cloud. Instead, it isolates the average relationship between size and cost after controlling for these confounding factors.

Once project characteristics are accounted for, the estimated relationship is no longer one of constant returns to scale. The curvature of the fitted line indicates that total cost increases less than proportionally with terminal size. In practical terms, larger terminals tend to benefit from economies of scale that are not immediately visible in the unadjusted scatter of observations.

The relationship begins to flatten beyond around 100,000 m^2, implying that large hub terminals should, in principle, achieve material economies of scale as fixed design, management, and mobilisation costs are spread over greater area.

Projects that lie above the fitted curve are therefore more expensive than would be expected given their size and average project characteristics. In many cases, such deviations reflect specific and exceptional features rather than general delivery inefficiency. Some terminals embed unusually high technical specification, such as enhanced seismic resilience, redundancy, or security requirements. Others reflect singular architectural ambition or flagship design choices that materially increase cost.[8] These projects are expensive by construction.

Within this adjusted framework, Heathrow's Terminal 2 and Terminal 5 sit statistically significantly above the fitted cost curve. This shows that costs are higher than would normally be expected for terminals of this size. Both assets fall squarely within the size range where economies of scale should be strongest, and their scale would normally place them toward the lower end of the unit cost distribution. If Heathrow's terminals were typical of the average airport in the sample, with broadly standard specification relative to capacity, there would be no reason for them to sit above the fitted curve.[9]

Yet the opposite is observed. As shown in Section 7, Heathrow's terminals consistently occupy the upper quartile or higher across unit cost benchmarks. The fitted cost relationship therefore reinforces the broader benchmark findings. Heathrow's cost position sits persistently above the international norm, not because it is unusually large, but despite its scale, which should in principle confer cost advantages.

This distinction is critical. While a small number of terminals exceed Heathrow in absolute cost terms, those cases reflect exceptional design ambition or technical requirements. Heathrow's position is different. Its costs remain high even after accounting for scale and average project characteristics, indicating that the premium is not driven by size, but by how large terminal projects are planned and delivered.

8.3. Returns-to-Scale Elasticity

Figure 19 illustrates the same cost–size relationship in terms of elasticity, that is, the percentage change in total cost associated with a one-percent change in terminal floor area.

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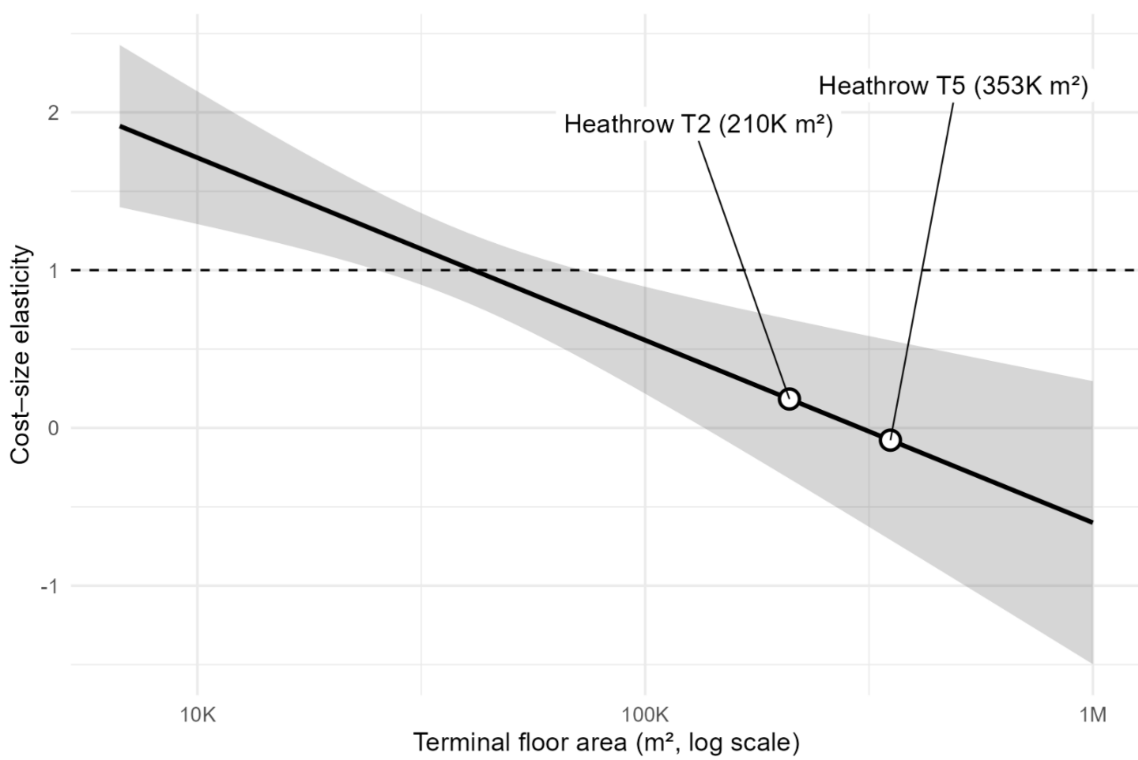
[8] Examples include Seoul Incheon International Airport, which incorporates elevated seismic and resilience standards alongside extensive system redundancy, and Beijing Daxing International Airport, whose cost reflects exceptional architectural complexity and national flagship ambition.

[9] On observable design measures, including square metres per passenger, Heathrow's terminals are close to the large hub average, suggesting the remaining cost premium reflects factors not captured in these metrics.

An elasticity of 1 indicates constant returns to scale: a 10 % increase in size would raise total cost by exactly 10 %. Values below 1 imply economies of scale, where cost grows more slowly than size, while values above 1 imply diseconomies of scale, where cost grows faster.

Across the global dataset, cost elasticity declines systematically with terminal size: small facilities exhibit elasticities above one, while larger terminals fall clearly below one. This indicates that large terminals experience moderate economies of scale, with total costs rising less than proportionally as floor area increases.

Figure 19: Returns-to-Scale Elasticity by Terminal Size



Heathrow's Terminal 2 (210 000 m^2) and Terminal 5 (353 000 m^2) fall squarely within the size range where elasticity drops below one, meaning they should, in principle, benefit from scale-driven efficiency. Yet both sit above the global cost curve (Figure 18), indicating that their observed costs are higher than predicted for their size.

In other words, Heathrow's terminals are large enough to enjoy cost advantages but fail to do so in practice, demonstrating that the airport has not captured the economies of scale observed internationally.

8.4. Interpretation

The regression results and fitted curves together reveal a clear and statistically significant global pattern: as terminals grow, costs rise sub-linearly, producing economies of scale. Heathrow's terminals are clear exceptions. Despite their size and maturity, they fall well above the predicted cost curve, meaning they are more expensive than their global peers even after controlling for scale.

In other words, Heathrow's premium cannot be explained by being "big." If scale effects operated as expected, Heathrow's size should make it cheaper, not costlier.

8.5. Implications

This analysis reinforces the broader benchmark conclusion: Heathrow's projects do not sit at the high end simply because they are large; they sit there in spite of being large. Globally, airports of comparable or smaller scale (e.g., Madrid Barajas T4, Seoul Incheon T2, Toronto Pearson T1) deliver at median or sub-median unit costs. Heathrow's persistent position in the upper quartile or decile therefore represents a structural cost premium, not a function of scale.

9. Discussion and Interpretation

The collective results of this benchmarking analysis convey a consistent finding: Heathrow's projects occupy the upper range of international cost distributions across all asset classes. The premium persists under different scope definitions, price normalisations, and reference-class subsets, indicating that the finding is structural rather than statistical.

9.1. Structural Nature of Heathrow's Cost Premium

Three layers of evidence indicate that Heathrow's elevated cost position reflects a systemic feature of its delivery environment, rather than isolated project characteristics or temporary market effects.

The existence of a small number of more expensive terminal projects elsewhere does not weaken this conclusion. Rather, it highlights that Heathrow's cost premium is unusual because it arises without the extreme design ambition, spatial generosity, or singular delivery contexts that characterise those few higher-cost cases.

First, the consistency of the premium across independent asset classes demonstrates that the finding is not random or asset-specific. Heathrow's position in the upper quartile or decile is repeated under multiple benchmarking metrics, suggesting a persistent pattern.

Second, all benchmarks are normalised to a common price base, removing inflation, exchange-rate, and national price-level effects. The residual differences therefore reflect Heathrow-specific factors rather than macroeconomic conditions.

Third, Heathrow's cost rankings remain high even when the reference class is limited to more contextually comparable subsets, for example new terminals built at existing airports or other brownfield hub expansions. This demonstrates that not all the results can be explained by sample composition or differences in project context.

Taken together, these three strands of evidence show that Heathrow's cost profile is structurally high. The premium is embedded in how projects are conceived, managed, and delivered, not in how they are priced or compared.

9.2. Complexity, Regulation, and Delivery Environment

A common argument is that Heathrow's operational and regulatory environment creates delivery conditions that may increase costs, for example by requiring construction within a live hub airport, maintaining continuous operations, and meeting strict safety and security requirements. While these factors could place upward pressure on costs, similar conditions apply at other major hub airports. Madrid Barajas, Toronto Pearson and Seoul Incheon, among others, operate with comparable levels of complexity and constraint, yet deliver terminal investments at substantially lower unit costs.

9.3. Scale, Integration, and Efficiency

Econometric testing confirms that larger terminals tend to achieve economies of scale internationally: total cost rises sub-linearly with size. Heathrow's T2 and T5, both within the size range where cost efficiency should peak, instead remain far above the fitted cost curve. This indicates that scale has not produced the expected efficiency gains. Factors inherent to Heathrow's project delivery approach appear to neutralise, or even reverse, the benefits typically associated with large-scale development.

10. Limitations and Caveats

While the benchmarking evidence is comprehensive, several limitations warrant explicit recognition:

1. **Data Coverage and Sample Size**: Certain asset classes, notably baggage-handling systems and runways, have smaller sample sizes, which limit statistical precision at the extreme tails of the distribution.

2. **Data Granularity**: Some international datasets aggregate cost categories differently (e.g., inclusion or exclusion of utilities, site works, or fit-out). Efforts were made to harmonise these definitions, but residual variation remains.

3. **Scope Alignment**: While terminal, runway, and car-park benchmarks align well with Heathrow's scope definitions, baggage systems remain idiosyncratic. Differences in automation, redundancy, and integration may influence apparent outliers.

4. **Not Causal**: The analysis does not aim to establish causal relationships. It identifies relative cost positions across projects but does not attribute specific portions of the cost premium to individual explanatory factors. Quantifying the contribution of elements such as governance arrangements, risk allocation or regulatory effectiveness would require dedicated econometric analysis that is beyond the scope of this assessment.

5. **Future Developments**: The H8 and Modernising Heathrow programmes are evolving. As project definitions mature, cost baselines may change. The present benchmarks therefore provide a snapshot for regulatory context, not a prediction of final outcomes.

Despite these limitations, the consistency and magnitude of Heathrow's relative cost position across asset classes strongly support the overall conclusion: the results are robust to reasonable variations in data, definition, and sample composition.

11. Conclusions

This Benchmark Report establishes a clear empirical foundation for understanding Heathrow's capital cost performance. Across all major asset types, including terminals, runways, baggage systems and car parks, Heathrow's projects occupy the upper end of global cost distributions, even after full price level and scope normalisation.

The analysis demonstrates that:

- Heathrow's high costs persist across metrics, suggesting a structural pattern rather than isolated anomalies.
- Economies of scale that are observed globally do not materialise at Heathrow, implying inefficiencies in project integration and delivery governance.
- Although compliance and regulatory requirements may contribute to higher delivery costs, they do not on their own account for the scale of the premium observed in

Heathrow's major terminal projects. Many other hub airports operate under similarly demanding regulatory conditions yet deliver at substantially lower unit costs.

The evidence therefore supports three overarching conclusions:

1. **Structural Cost Premium:** Heathrow's capital delivery framework consistently yields higher costs than comparable international airports, even after controlling for scope, context, and price level.
2. **Ineffective Scale Realisation:** Larger project size does not translate into proportional cost savings, suggesting that potential economies of scale are not being captured within Heathrow's delivery model.
3. **Institutional Delivery Constraints:** The persistence of high costs across all asset types indicates the need to examine how governance, procurement practices, and cost-assurance mechanisms shape overall delivery performance at Heathrow.

In sum, Heathrow's infrastructure is delivered at prices that sit well above those of comparable international airports. The challenge for the coming decade is to maintain performance while reducing the cost of delivery.