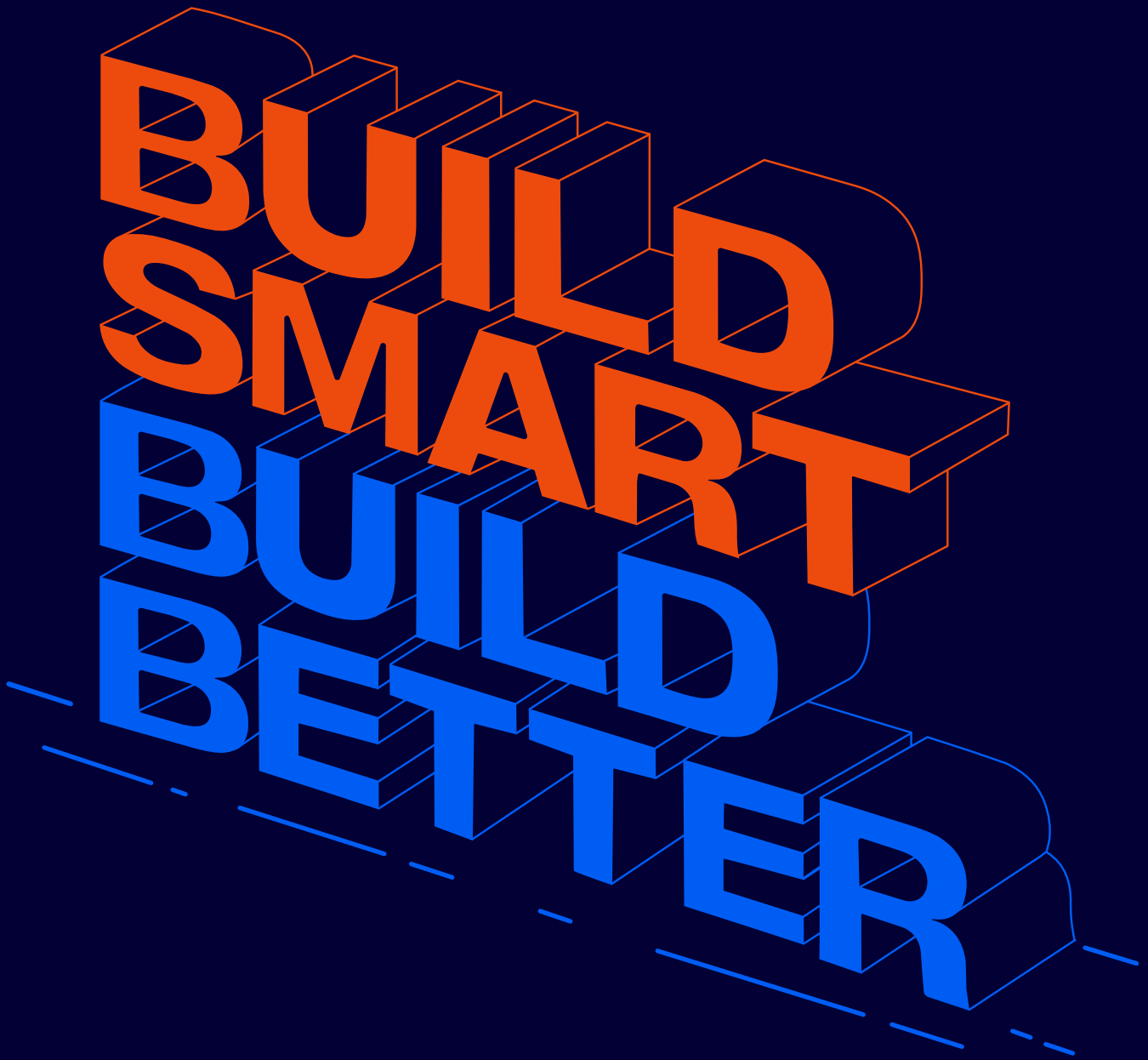
mace



MACE CONSTRUCT

MACE CONSTRUCT'S PRODUCTIVITY COMMITMENT

We are aiming to become the most productive construction firm in the UK by 2030

We are committing to publish independently audited productivity figures, annually. In doing so, we hope to encourage our peers to do the same, leading to a snowball effect across the industry, like the KPI-driven cultural shifts we've seen in health and safety, or more recently carbon. This could be facilitated by an industry body such as Build UK, similar to how payment performance is currently. What gets measured gets improved.

In this report we establish a baseline of £67 of gross value added (GVA) per worker hour (excluding extreme outliers).

This is already well above the industry average of £37.38 per worker hour, but we believe we can go much further.

Currently, the top-performing half of our projects achieve more than £100 per worker hour. By 2030, we aim for this to become our new baseline across all our projects, representing a 51% improvement in productivity.

CONTENTS

EXECUTIVE SUMMARY

Highlighting the construction industry's low levels of productivity is nothing new. It's been a persistent problem for decades, one that Latham wrote about in 1994, and Egan returned to in 1998. By 2016, Farmer was telling the industry that it needed to 'modernise or die'.

Our sector remains around...

⇩ 20%

less productive than it was in the 1970s; while on the same measure, manufacturing has improved by...

⇧ 183%

Each review reached broadly the same conclusions, and each time, the problem was successfully challenged in theory, but in practice there were minimal meaningful changes made and, in most cases, a widespread return to business as usual.

In 2026, the industry is facing even greater challenges to productivity. Many firms cannot tell you how productive their projects are. They do not know what value their projects deliver per hour, how much of their forecast margin survives delivery, their levels of pre-manufactured value or how many productive hours are actually spent per working day on-site.

In the absence of a large evidence base, the productivity debate is often being driven by anecdotes and piloting one-off approaches in silos, as a response. That is not a foundation on which a £700 billion pipeline can be delivered, or an industry can be transformed.

We want to be part of the solution. We opened up our project data to shine a light on what works, what doesn't and the drivers of productivity industry wide.

The diagnosis in this report corroborates what others have previously found but adds to the findings in three important ways.

Firstly, for the first time this report quantifies the significant impact that high workforce churn rates are having on productivity.

Secondly, we have analysed in detail 234 of Mace Construct's projects from the last five years. We looked at a number of variables, including value generated, margin, workforce composition, contracting models, the use of modern methods of construction, and the maturity of digital tools.

Thirdly, we stress-tested our findings through interviews with clients, investors, designers and policymakers from across the industry. These conversations gave us invaluable insight into the future of the industry and how leading experts expect construction sites to look by 2040.

We have taken a risk, by sharing the productivity findings based on our own data, in the hope that others will follow. If we are serious about lifting productivity, we have to be serious about measuring it, serious about sharing what we find and serious about changing how we work and evolving the culture in our industry. We have therefore made a commitment to become the most productive contractor in the UK by 2030.

We hope that clients, industry colleagues and policymakers read this report and its recommendations closely, and that it helps move the industry beyond the conversation it has been having since 1994.

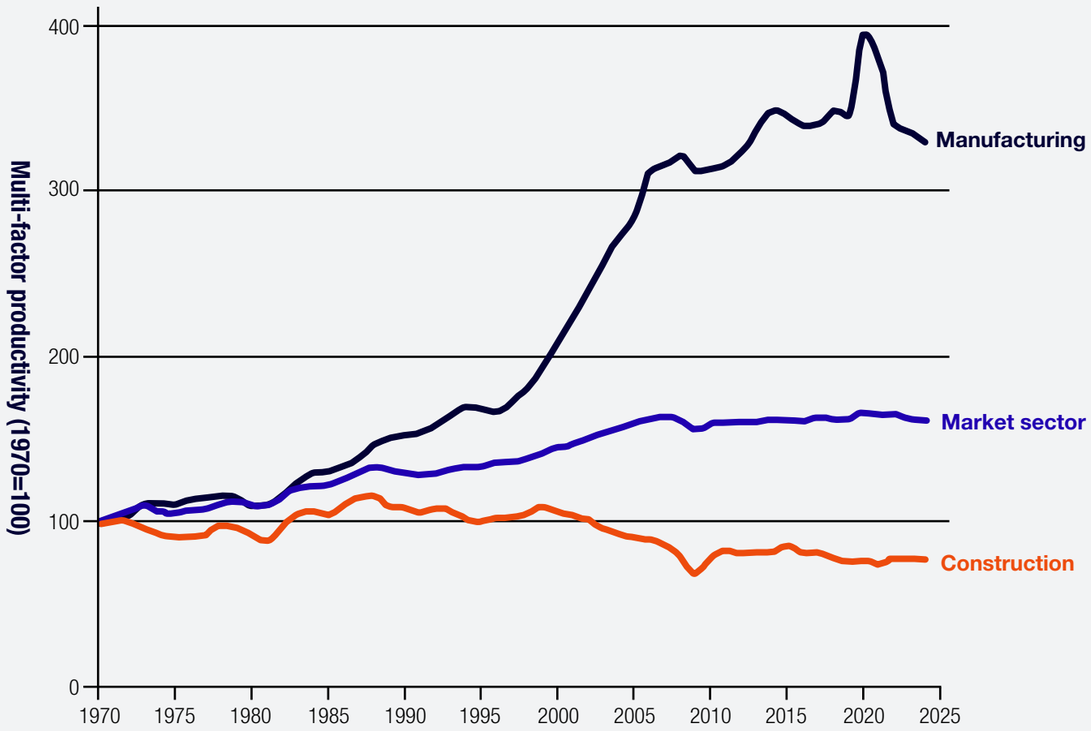
INTRODUCTION

UK construction productivity is roughly 20% lower today than it was in the 1970s. The Construction Leadership Council estimates that improving construction productivity could generate an additional £45 billion of value each year.[i]

Between 1997 and 2022, it improved by about 1%, against 182% for manufacturing and 29% for the economy as a whole (market sector).[ii] Almost no other major sector has stood still for that long.

Figure 1: Multi-factor productivity in construction, manufacturing and market sector, UK 1970-2024 (1970=100)

Construction productivity has shrunk by over 20% since 1970, while manufacturing productivity has more than tripled.



Source: ONS

The UK is now committing to build at a scale it has not attempted in decades.

More than...

£700bn

of schemes are identified in the National Infrastructure and Skills Taskforce Assessment (NISTA) infrastructure pipeline. Attempting that level of growth activity in a sector whose productivity has been stagnant for half a century may not be viable.

This report draws on two data sources. The first is project-level data from 234 schemes delivered by Mace Construct between 2019 and 2025. This covers hours worked, value generated, margin retained, workforce composition, contract structure and a range of other variables. To our knowledge, this report marks one of the first times a major UK contractor has opened up its portfolio to productivity analysis on this scale. The dataset is one firm's records, rather than a representative sample of UK construction, but this is also what makes it unique and useful. Many firms in the sector do not systematically measure productivity at all.[iii]

The second is more than twenty interviews with senior figures across the construction ecosystem, conducted between January and March 2026. These included developers, investors, architects, engineers, technology firms, public-sector procurement bodies and academic researchers. The interviews were designed to test the data and to add context to the findings that the figures alone could not.

Workforce churn carries a substantial productivity cost on large sites. Modern methods of construction and digital coordination raise the share of labour that ends up contributing to commercial value, when designed in early. We know that early contractor involvement on complex schemes retains more margin than single-stage tendering against a finished design. And that stable, well-led projects, where supply chain collaboration is prioritised and risk distributed equitably, produce better outcomes across almost multiple performance measures. This broad direction is consistent with the findings of Latham, Egan and Farmer over the past 30 years. What this report adds is the evidence base: project-level data from a major contractor's own portfolio, measured in hours, pounds and margin, showing where and how much these effects actually cost.

Two findings in the analysis go beyond confirming the established diagnosis of Latham, Egan and Farmer. The first is that almost every productivity-improving intervention the data picks up scales with the size of the scheme and has a much flatter effect on smaller jobs. The second is that construction productivity is not a single thing. Hourly output and commercial value retention respond to different interventions, and a project can do well on one while doing badly on the other. Both findings shape the rest of the report.

If the diagnosis has been consistent for thirty years, the obvious question is why so little has changed. This report is our attempt to answer that question.

"We need to get better at capturing real-time learnings from site and re-using them on the next project: everything from decisions to fabrication-ready information."

Dale Sinclair,
Global MMC Lead, UK Head of Digital Innovation, WSP

INTRODUCING THE DATA

This analysis uses data from 234 projects delivered by Mace Construct between 2019 and 2025, drawn from day-to-day project records. To our knowledge, this is one of the first times a UK contractor has opened up its project data to this kind of productivity analysis.

The data set reflects one contractor's portfolio rather than the sector as a whole, but it provides a consistent, project-level view of productivity, workforce composition, commercial outcomes and how projects are actually delivered. This allows for like-for-like comparison across projects, showing how different approaches translate into different outcomes.

Data at this level of detail remains uncommon in the sector. As several interviewees noted, many firms still do not systematically measure productivity at all.

Three measures of productivity

We work with three measures of performance. Each captures a different dimension of productivity, but these measures do not consistently move together.

The first is output per hour worked, or gross value added (GVA) per hour. This is the rate at which labour time is converted into measurable output, calculated from Mace Construct's cost records during delivery. It follows the same core logic as the Construction Productivity Taskforce's framework: the value of work completed divided by hours worked on-site.[xix]

Our figures differ from the Office for National Statistics (ONS) national productivity statistics in one important respect. ONS measures are constructed after the fact from sector-wide revenues. Ours are calculated during delivery from one contractor's records, and capture the value generated within Mace Construct's part of the delivery chain rather than the full value chain. Our figures may not be directly comparable to national statistics, but they are internally consistent and well suited to the comparisons that follow.

The second measure is gross contribution per worker, which captures how much of the work being done ultimately contributes to commercial value. The third, is margin erosion as a percentage of bid value, which shows how reliably that commercial value is retained during delivery.

The three show little correlation with each other. A project that achieves high output per hour is no more or less likely to retain its commercial margin than one that does not. Construction productivity, in other words, is not a single thing. A project can convert labour hours into output efficiently and still fail to translate that output into commercial value, or the other way round.

1

Output per hour worked, or gross value added (GVA) per hour.

This is the rate at which labour time is converted into measurable output.

2

Gross contribution per worker.

This captures how much of the work being done ultimately contributes to commercial value.

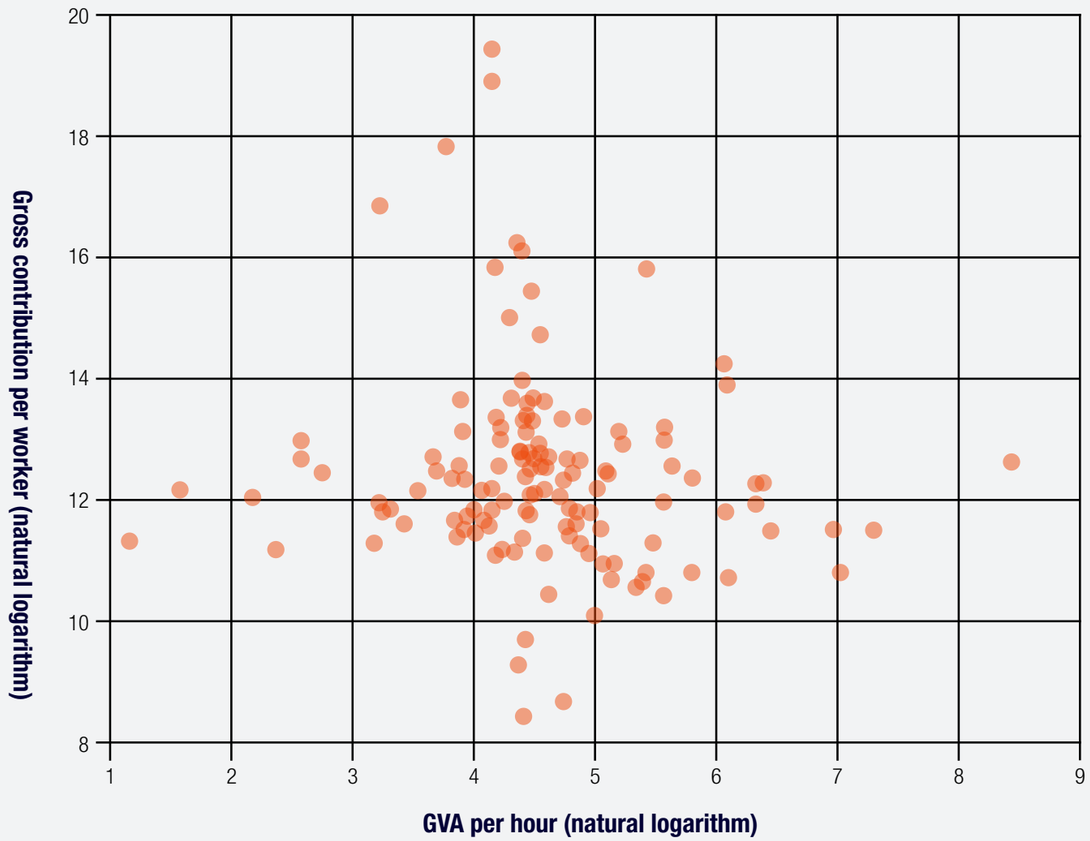
3

Margin erosion as a percentage of bid value.

This shows how reliably that commercial value is retained during delivery.

Figure 3: GVA per hour vs gross contribution per worker

There is no clear correlation between GVA per hour and gross contribution per worker – they capture fundamentally different elements of construction productivity.



Source: Bradshaw Advisory analysis of Mace Construct data. Both axes are shown on a logarithmic scale, a standard approach for data with a wide spread of values. This prevents a small number of very high-value projects from compressing the rest of the data into an unreadable cluster.

Interviewees made the same point in a different way. Clients and contractors often don't align on productivity because they are measuring different aspects of it – programme certainty for one, hourly output for another, and margin retention for a third. The data confirms that these are genuinely independent dimensions of performance.

The one meaningful relationship among these three aspects of performance is between gross contribution per worker and margin erosion. Projects that generate more commercial value per unit of labour also tend to retain more of it. This points to a common underlying factor of management quality and project set-up which drives both value creation and value retention.

The sample

The portfolio spans a range of market sectors. The two largest are commercial offices (92 projects) and aviation, dominated by the Heathrow framework (78 projects). Life sciences and pharma account for 12 projects, education and data centres for ten each, hotels and residential for nine, and the remainder is split across mixed-use commercial, government estates, rail, energy and a small number of other sectors.

Project scale varies widely. Bid values run from under £1 million to over £650 million, with a median of around £27 million. Median duration is 21 months. Median headcount is 20 core Mace Construct staff per month, though some projects run into the several hundreds.

Data coverage varies by measure. Gross value added (GVA) per hour is available for 232 of the 234 projects, gross contribution per worker for 158, and margin erosion for 114. 108 projects have data across all three.

The shape of the sample reflects two things at once: the work Mace Construct has been doing over the period, and the work for which it holds reasonably complete records. The dominance of aviation work in the sample reflects Mace Construct's long-running framework relationship with Heathrow, which has generated a large number of individually recorded projects over the period. Other parts of the business are well represented but in smaller numbers. The balance of the sample should not be read as a statement about the balance of Mace Construct's wider portfolio or revenue, nor should it be taken as a stratified sample of UK construction. The analysis that follows is best read as a basis for within-sample comparison, rather than as a read-across of the sector as a whole.

When this report refers to 'larger' or 'smaller' projects, it is describing a continuum rather than a threshold. The median project in the portfolio has a bid value of around £27 million. Projects well above that, for example those with several hundred workers, bid values above £100 million, durations of three years or more, are where the effects of interventions like workforce stability, contracting model and off-site manufacturing become most commercially significant. The effects are proportional rather than binary: they grow steadily with project scale, rather than switching on at a particular size.

Our typical project generates around...

£86*

of GVA per hour worked, with wide variation around that figure.

* Including outliers

Gross contribution per worker has a median of around...

£172,000

per annum.

Three building types dominate the portfolio: airport work (73 projects), new build (57) and fit out (42). They behave very differently. Fit out projects achieve the highest median GVA per hour, at around £131 – roughly double the airport figure of £63. (This is the median across the airport projects in our sample, not a statement about airport construction productivity in general).

With new build sitting between these fit-out and airport projects at £80, we can see that the pattern of GVA per worker hour reflects the nature of the work. Fit-out projects are shorter, more clearly scoped and higher in value density. Airport projects operate in live, security-constrained environments with substantial coordination overhead.

The most productive building type on an hourly basis is not the most commercially successful. Airport projects, despite lower GVA per hour, show median margin erosion of essentially zero – a reflection of the stable framework arrangements and collaborative contracting that characterises the work. New build projects, with moderate hourly output, show the worst margin erosion. How a project is structured matters as much as how quickly it is done.

A natural expectation might be that larger projects, with greater resources and scope for specialisation, would be more productive. The data does not support this. The relationship between average headcount and GVA per hour is essentially flat.

Larger projects do generate more total commercial value, and each worker's share of that value is larger – median gross contribution per worker on the largest quartile is more than double that of the smallest. But that reflects scale, rather than efficiency. This distinction runs through the rest of the analysis.

Sophisticated methods go on difficult projects

A pattern runs through the descriptive results above and shapes everything that follows. The interventions the industry looks to for productivity improvement – modern methods of construction, digital tools, collaborative contracting, early contractor involvement – are not applied randomly across the portfolio. They are concentrated in the kinds of projects where productivity is hardest to achieve: larger, more complex, longer-duration schemes with greater coordination demands.

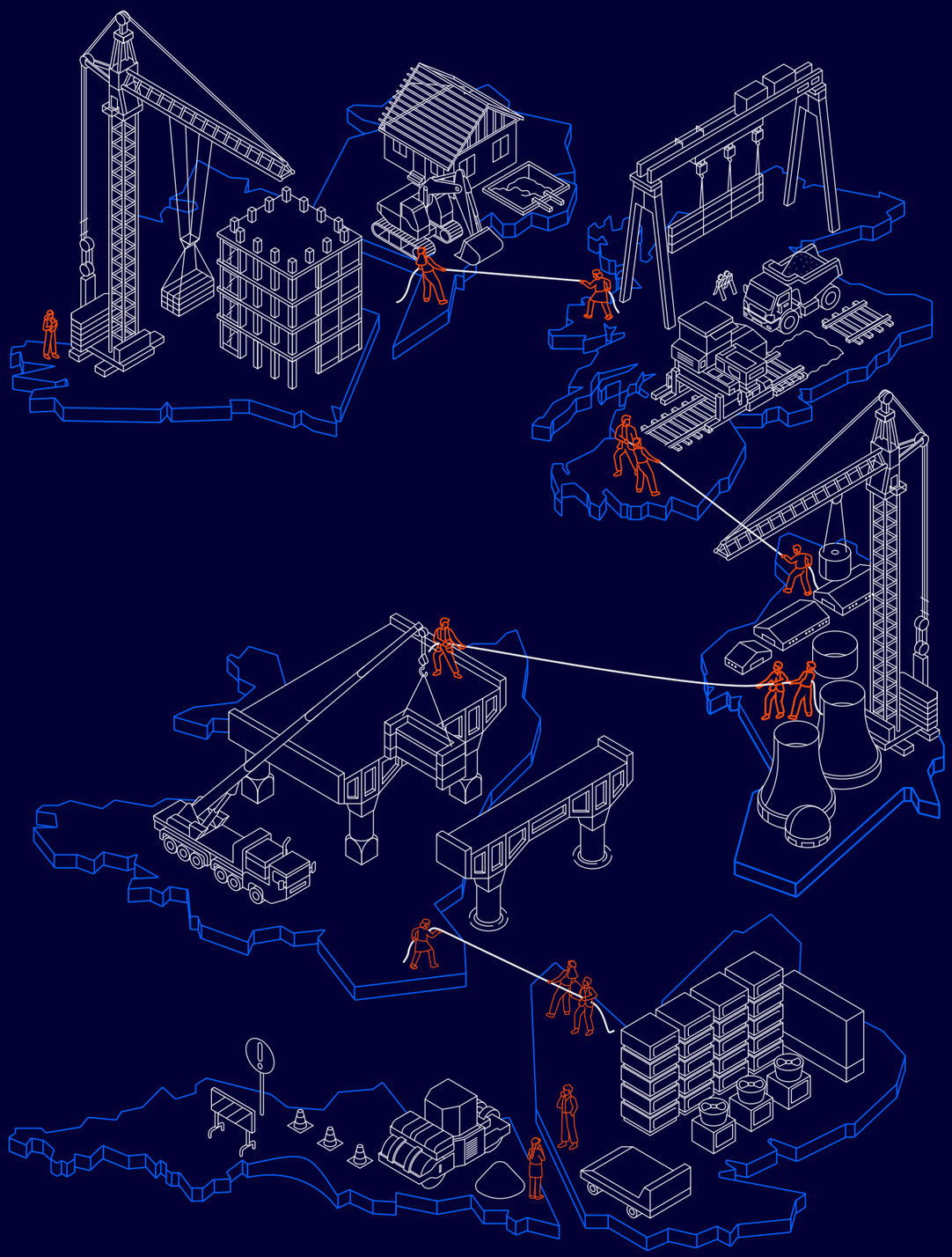
This is rational behaviour. We wouldn't apply volumetric MMC to a small fit-out or invest in a high-maturity digital environment for a six-month refurbishment. It is also worth noting that productivity is not pursued in the same way across different asset types. An airport operator may track seventeen distinct aspects of efficiency across its programme; a commercial office developer may focus on three or four.

What counts as a productivity improvement on a live, security-constrained airport environment is different from what counts on a straightforward commercial new build, and both are different again from a data centre or a hospital. The analysis that follows looks for patterns across the portfolio as a whole, but we should bear in mind that the projects within it are not all trying to do the same thing.

The projects that attract more sophisticated approaches are precisely the ones where the stakes, the complexity and the potential payoff are highest.

The consequence is that raw descriptive comparisons are misleading. Many of the most promising interventions appear in the data alongside lower hourly output, given that they are being deployed on projects that would have lower hourly output regardless.

This shapes how the rest of this report should be read. A simple comparison between projects with and without MMC partly reflects the difference between a large, complex airport scheme and a straightforward commercial fit-out. The analysis that follows is designed to separate the two effects. Where the data supports it, we look at how intervention variables perform once project size, sector and contract type are taken into account. Where the data is thinner, we lean on descriptive comparisons and the evidence from more than twenty interviews across the industry.



THE UK CONSTRUCTION LANDSCAPE

Construction generates around 9% of UK GDP and employs about 2.1 million people,[iv] making it one of the country's most economically significant sectors. Yet despite its scale, productivity performance has declined rather than improved.

ONS data shows two distinct drops in construction output per hour: one around 1998, and a steeper, sustained decline from 2005 to 2008.[v] Almost two decades later, and the industry is yet to recover.

The truth is that the UK ranks lower than other regions, despite Brian Potter's (author of the Construction Physics blog) documentation[vi] of stagnation across the majority of developed economies. Hickory Group, a Mace Construct partner in Melbourne, completes high-rise residential buildings of similar complexity to UK schemes in roughly half the time.

Singapore, Japan and Hong Kong all achieve consistently higher productivity, driven by sustained government support for standardisation, workforce development and offsite manufacture.[vii] None of this rests on technology the UK cannot access. It rests on different procurement cultures, different relationships between clients, designers and contractors, and far higher rates of direct employment.

The structure of the UK industry helps explain the gap. There are roughly 370,000 VAT-registered construction firms in Great Britain, and around 98% of them employ fewer than 50 people.[viii] Self-employment accounts for about 37% of the workforce against a national average closer to 13%, with around 748,000 self-employed workers registered in the sector.[ix]

The consequences of this structure play out at a project level in ways that are not always visible from the outside. A major scheme may have five or six tier 2 contractors on paper, but each of those firms will subcontract elements of their own scope, and those subcontractors may subcontract again. A single project can easily involve thirty or forty firms in practice, many of them employing fewer than a dozen people, with no direct contractual relationship to the client or to each other. Each layer adds a margin, a management interface and a point at which accountability for quality and productivity is diluted. By the time work reaches the operative on the tools, the chain between the person paying for the building and the person building it can be four or five links long.

The figure has been broadly stable since 1997, yet it conceals a structural shift from genuine entrepreneurial self-employment to what regulators, trade unions and the Farmer Review have all described as 'bogus self-employment' – workers registered as Construction Industry Scheme (CIS)[x] subcontractors, but operating in practice as direct employees. This is one of the reasons Farmer's 2016 review described the sector as facing 'inexorable decline'.[xi]

"RIBA stage 3 or 4 to the end in the UK can often take three or four years. They're building whole manufacturing plants in China in less time."

John Bailey,
Senior Director Capital Construction & Workplace Strategy, AstraZeneca

Firms without scale cannot invest in training, technology or process improvement, and an industry already operating on tight margins, compounded by stale productivity, simply cannot generate the profits to invest – with some clients seeing the issue as *'not their problem and something purely for the construction industry to solve'*. The same dynamics play out in workforce continuity, design-stage commitment, and the take-up of the innovations the industry has spent thirty years recommending to itself.

Three decades of major reviews have all reached broadly the same conclusions. Latham in 1994 called for collaborative contracting, less adversarial relationships, and 30% cost reductions through partnering and process improvement.[xii] Egan in 1998, added supply chain integration, performance measurement and client leadership.[xiii] Construction 2025, published by the Government in 2013, set targets of 33% lower costs, 50% faster delivery and a 50% reduction in emissions. Farmer in 2016 was the bluntest, saying the industry was in a position where it must *'modernise or die'*.[xiv]

The 2020 Construction Playbook set out a presumption in favour of modern methods, longer-term contracting and outcome-based specification on public projects.[xv] Each was followed by a wave of commitments and pilots. Each was followed, broadly, by a return to business as usual.

The planning and approvals system is a further structural constraint that the sector has limited ability to address on its own. Delays and uncertainty in planning consent, building control sign-off, and regulatory gateway approvals add time to programmes in ways that do not show up in any measure of site productivity, but directly affect the cost and efficiency of delivery.

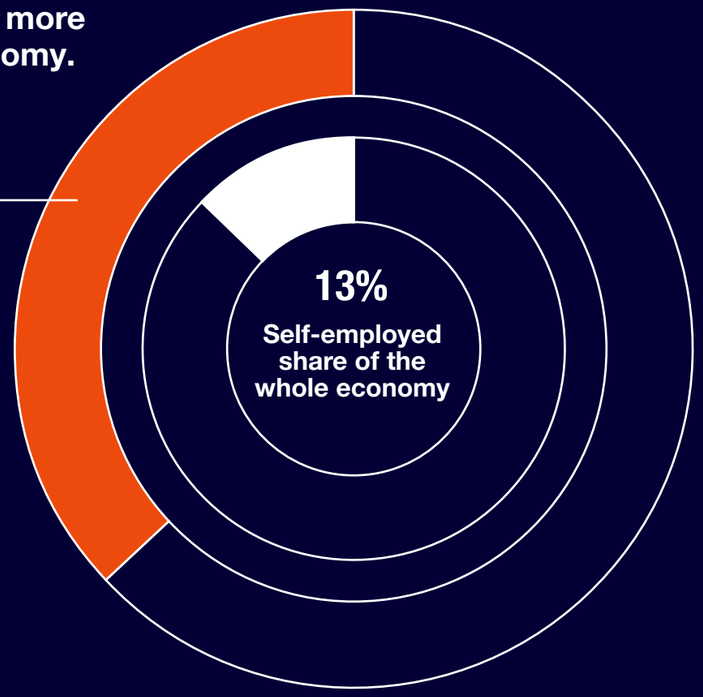
A project that waits six months for a planning decision or is held at a building control gateway while documentation is reviewed is carrying overhead, holding supply chain commitments, and losing programme momentum for reasons entirely outside the contractor's control.

Figure 2: Self-employed and employed share of the workforce in construction sector and whole economy

Construction relies on self-employment three times more than the rest of the economy.

37%

Self-employed share of the construction sector



Source: ONS, Labour Force Survey

“You might only do a feasibility study and then it stops for a year. Then you do another feasibility study and it stops again because the numbers don’t add up.”

Design Director
Engineering Firm

The cumulative effect across the pipeline is substantial. Several interviewees described the approvals environment as a system-level productivity constraint comparable in scale to the procurement and contracting issues the rest of this report addresses, and one that has received considerably less attention.

The interviews conducted for this report offer a different lens on these time-worn issues:

- Karen Yorath, Infrastructure Delivery Director at Heathrow, makes the case that the biggest productivity impact occurs at the earliest project stages, and that clients commonly under-invest there.
- Richard Surma, Head of Estates & Capital Development at AstraZeneca, argues for replacing project briefs with operating briefs. These describe what a facility actually needs to do to operate rather than what it needs to look like, helping to force operational thinking into the process at RIBA Stage 0.
- On technology, Fergus Harradence, Deputy Director, Construction, Logistics, Airports & Water at the Department for Business and Trade, said that the BIM mandate is fifteen years old and increasingly out of date, as the focus is on BIM and design rather than information management over the lifecycle of an asset, which is what it should drive.
- Richard French, Innovation Lead at i3D Robotics argues the binding constraint on robotics adoption in UK construction is simply the fact that UK buildings and materials are not designed for robotic handling or installation. Mitigation uses ten-micron precision which increases cost and is wasted in environments built to much looser tolerances.

The Construction Industry Training Board (CITB) has projected the sector will need an additional...

41,200

workers per year.[xvi]

This is in the face of an estimated...

400,000

retirements from construction over the next five to ten years.[xviii]

The picture across the literature, the interviews and the historical data is consistent. As we will find, the analysis on Mace Construct’s own data also matches up well. What appears to be missing is the coherent set of actions and structural change that should follow these findings.

WHAT THE DATA TELLS US

The findings in this report come from Mace Construct’s own project records – 234 schemes delivered between 2019 and 2025, measured in hours worked, value generated and margin retained – rather than inferred from sector-wide aggregates or drawn from interview testimony alone.

For the first time, the claims that three decades of industry reviews have made about workforce stability, early contractor involvement, modern methods and collaborative procurement can be tested against a major contractor's actual delivery data.

What we have learned

The diagnosis holds: workforce churn costs productivity on large sites. Early involvement retains more value than single-stage tendering. Modern methods reduce the share of labour absorbed by rework. Stable, well-led projects produce better outcomes across almost every dimension at once.

But the data also reveals aspects the earlier reviews could not. The impacts of scale are significant: nearly all interventions have greater importance in large, complex projects compared to smaller ones.

Perhaps more important is what we've learned about where the impacts of different candidate productivity interventions actually fall. Almost every intervention the data picks up as productivity-improving has its biggest effect on large, complex, long-duration projects.

On small schemes the picture is much flatter. Churn makes little measurable difference below around 250 operatives on-site. The procurement model barely moves the numbers on straightforward, quick-turnaround work. MMC is clustered on larger new-build and infrastructure schemes because those are the conditions under which off-site manufacture pays for itself.

The levers that matter take effect when the project is big enough, complex enough and long enough for the benefits to accumulate. This is the finding that matters most for the decade ahead, because the pipeline now being committed to is dominated by exactly that kind of project.

We have also found very clearly that construction productivity is not a single thing. Hourly output and commercial value retention are separate dimensions that respond to separate interventions, and a project can do well on one and badly on the other.

Within Mace Construct's data, MMC and digital approaches show up in the commercial retention numbers rather than the hourly output. This tells us something about where in the delivery pipeline those approaches actually do their work.

What other industries do differently: logistics as a productivity system

Other industries facing similar challenges of coordination, sequencing and scale have addressed them through logistics-led operating models rather than relying solely on labour productivity.

In advanced logistics and distribution, firms such as Amazon and Ocado treat productivity as a system-level outcome driven by:

- precise control of material flows
- minimisation of unnecessary movement
- automation of low-value tasks
- and the design of environments where work can be executed efficiently.

In these environments, workers do not spend time searching for materials, waiting for inputs or moving unnecessarily across large sites. Instead, logistics systems ensure that everything required to complete a task is available at the point of use, often within tightly controlled distances.

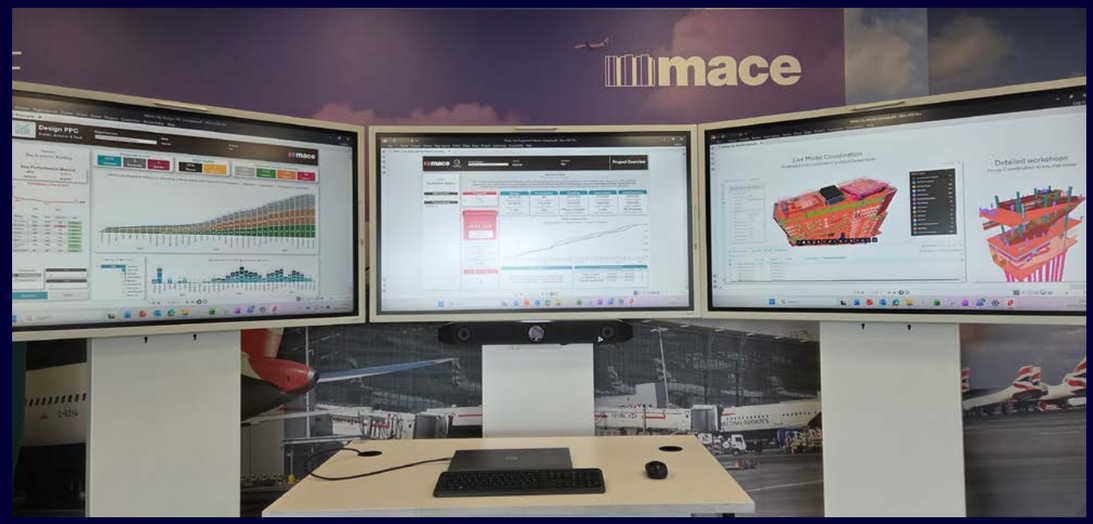
The parallel with construction is direct. Much of the lost productivity on construction sites, particularly larger ones, arises from poor coordination of labour and materials, rather than from the pace at which work itself is performed.

The implication is that improving construction productivity is not simply a question of working faster, but of designing and managing sites as integrated logistics systems, in the same way that leading logistics and manufacturing firms have done.

CASE STUDY

PROJECT LIFT

Improving productivity through reliable data and predictable performance.



Improving productivity in construction is not just about working harder on site. It is about removing the hidden inefficiencies that slow projects down before work even starts and throughout delivery. That is the aim of Mace Construct's internal digital transformation programme, Project LIFT, which rethinks how projects are set up, and how performance is managed and reported.

The challenge is familiar across the industry. Projects have long relied on bespoke reporting, duplicated processes and manual data handling. While often well intentioned, this absorbs valuable time and limits early insight, reducing teams' ability to act proactively.

Our response has been to simplify and standardise the foundations of project delivery, supported by smarter use of data, automation and emerging digital capability.

Projects are guided towards the right level of digital support and technology based on their size and complexity, improving mobilisation and avoiding over engineering.

Automated performance reporting replaces manual spreadsheets and presentation packs, cutting reporting effort while improving visibility of cost, programme, safety and risk. A consistent approach to risk management improves early visibility of emerging issues, reducing reactive management later in delivery.

Alongside this, digital and AI enabled solutions are reducing routine administrative tasks and accelerating information flow.

The result is tangible productivity improvement, faster decisions and more predictable project performance.

If we know how to improve, why haven't we?

If the industry has known for the last 30 years what can be done to improve productivity, and a major contractor's own project data now confirms it, the obvious question raised is why we have seen so few successful solutions. Part of the answer is in the demand for construction work the UK has generated over the same period.

In historical terms, the UK has not delivered much new infrastructure or housing at scale for a long time. No new reservoir of any size has been completed in England for more than 30 years.[xxvii] No new nuclear power station generating electricity since 1995.[xxviii] No new main-line railway of any length was built in the century before HS1.[xxix] Housing completions in England peaked at around 350,000 in the late 1960s and have not approached that figure since.[xxx] For the last year, housing starts fell to 142,000 – well below target – and came with limited levels of standardisation.

This is not the argument of the report, but the consequences for the construction sector are worth stating and how they have shaped the productivity issues we are analysing here.

This has had a huge impact on the structure of the construction sector itself. Over the past several decades, the order book has been patchier and more fragmented than it was in the post-war period. Less consistent delivery of large programmatic schemes, more repair and maintenance, more short-duration work for a changing cast of clients.

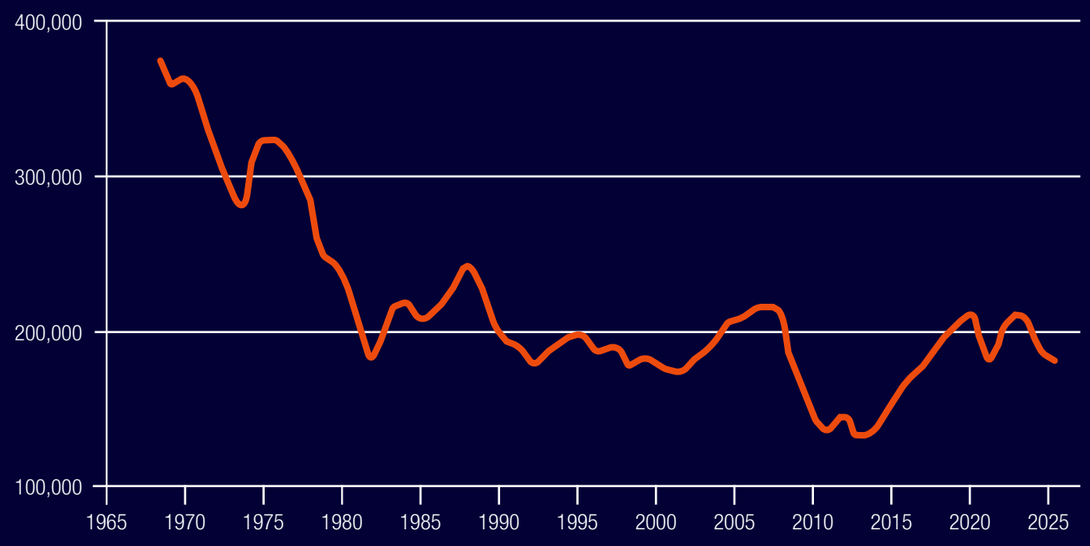
As a result, the industry adapted to this more fragmented landscape, with direct employment falling, self-employment rising to around 37%, and around 98% of businesses employing fewer than fifty people.[xxxi]

"Despite 30 years of reviews, culture remains sticky even as generations have shifted."

Paul Connolly,
Head of Technical Services, Mace Construct

Figure 8: Annual housing completions, UK, 1969 to today

Housing completions have never returned to their 1960s peak.



Source: MHCLG

Many contractors today, as Mark Robinson of SCAPE states, operate with very thin direct labour and push much of the responsibility for productivity onto a constantly shifting supply chain.

This is the sort of fragmentation and market structure that would directly feed into the high levels of workforce churn that our findings show to be dire signs for productivity.

The consequences of this extend far past churn. If the techniques that most reliably improve construction productivity are techniques that work best on large, long, repeatable schemes, and the pipeline for such schemes have been patchy, at best, for decades, there has been little room for those techniques to be deployed consistently or made part and parcel of how the sector operates.

Off-site manufacture rewards pipelines, not one-off jobs. Early contractor involvement rewards clients who will be back next year with another scheme, not clients running an occasional single procurement. Digital coordination rewards teams that build up cross-project knowledge, not teams that disband at handover. The type of work the UK has been commissioning for decades have not, in the main, been the type of work these techniques were built for.

This has all created a downward cycle, where a drop off in sustained demand for big project pipelines both leads to a sector which is more fragmented (diluting capability and accountability), as well as less able to apply the techniques and approaches that improve its productivity. Productivity then falls, making the delivery of large projects and pipelines painful when they do arrive.

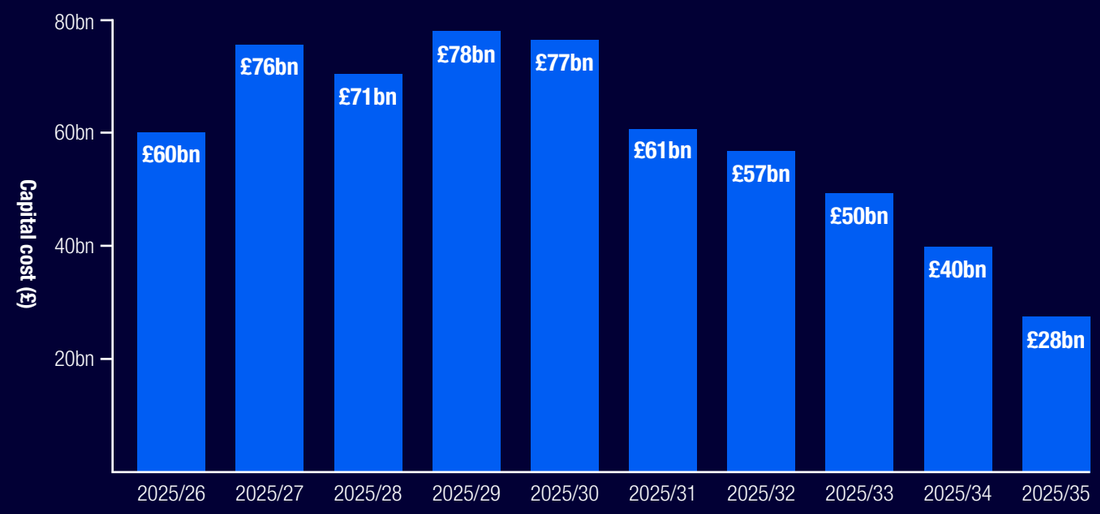
Hope on the horizon

Against that backdrop, something has shifted. In June 2025, the government published its first Ten Year Infrastructure Strategy, backed by at least £725 billion of committed funding across economic infrastructure, housing and social infrastructure.[xxxii] It is the first UK strategy to set out a long-term framework of that kind across all three at once.

In March 2026, the National Infrastructure and Service Transformation Authority launched a live Infrastructure Pipeline of 780 planned projects, updated at regular intervals and visible to the supply chain.[xxxiii]

Figure 9: Annual capital cost of projects on the NISTA Infrastructure Pipeline, 2025-2035

A decade of committed capital spending across the UK infrastructure pipeline.



Source: NISTA

The scale of what is now formally committed across nuclear, rail, water, energy transmission, housing and social infrastructure is larger than anything the UK has put forward in decades.[xxxiv] Sizewell C and the small modular reactor programme alone will, together with Hinkley Point C, deliver more new nuclear capacity over the next period than has been seen in decades. Similar statements could be made across several of the other sectors.

This is a genuine change in direction, and it is worth saying plainly that an industry that has spent decades adapting to patchy demand is now being told to expect something different. Mace Construct's own Executive Chair, Mark Reynolds, put the sector's position clearly when the NISTA pipeline was launched: the industry cannot invest in the skills, capacity and technology it needs without clarity on future workload. The pipeline, if it holds, is the beginning of that clarity.

What we've found in our analysis then suggests that the opportunity goes further than the scale of the investment on its own. Larger, longer, more consistent projects are the environments in which the things the industry already knows how to do actually work:

- Good working environments in which churn can be brought down.
- Early contractor involvement can be made the default.
- Modern methods can be designed in and paid back.
- Digital coordination and automation can compound across a programme rather than a single job.

For the first time in a long time, the pipeline the sector is being asked to deliver is one where its own best techniques bite hardest. There is a version of the industry over the next decade in which bigger projects make it easier to apply these solutions, and what we know works consistently.

It is the construction industry's responsibility to be ready to take advantage of the opportunity as (or if) it does materialise and the next few years are crucial. Being ready means:

- The procurement environments being set up now for the early projects in the pipeline.
- The measurement frameworks the sector puts in place to learn across schemes.
- The direct-employment and training commitments contractors make while the work is still committing to site.

These are the things that determine whether the pipeline, when it lands, is delivered in a way that allows the sector to turn its productivity around, replacing a vicious cycle with a virtuous one.

The recommendations that follow focus on a set of changes that the evidence in this report most strongly supports. They are the things the sector and its clients should be getting right now, while the early projects in the pipeline are being set up. Getting them right at this point has a much bigger impact on what is delivered over the next decade rather than attempting to correct the course later.

The recommendations are deliberately shared between clients, contractors and government. None of the changes the industry needs can be delivered by one of those stakeholders alone, and framing them as anyone's sole responsibility would be the quickest way to ensure they don't happen.

"Productivity for us is really about sticking to what's been agreed. We've got collaboration, we've got a framework, we've got a price, we've got a programme – and that needs to be achieved."

Bernhard Dachs,
Senior Director Investment and Development, Mitsubishi Estate

CASE STUDY

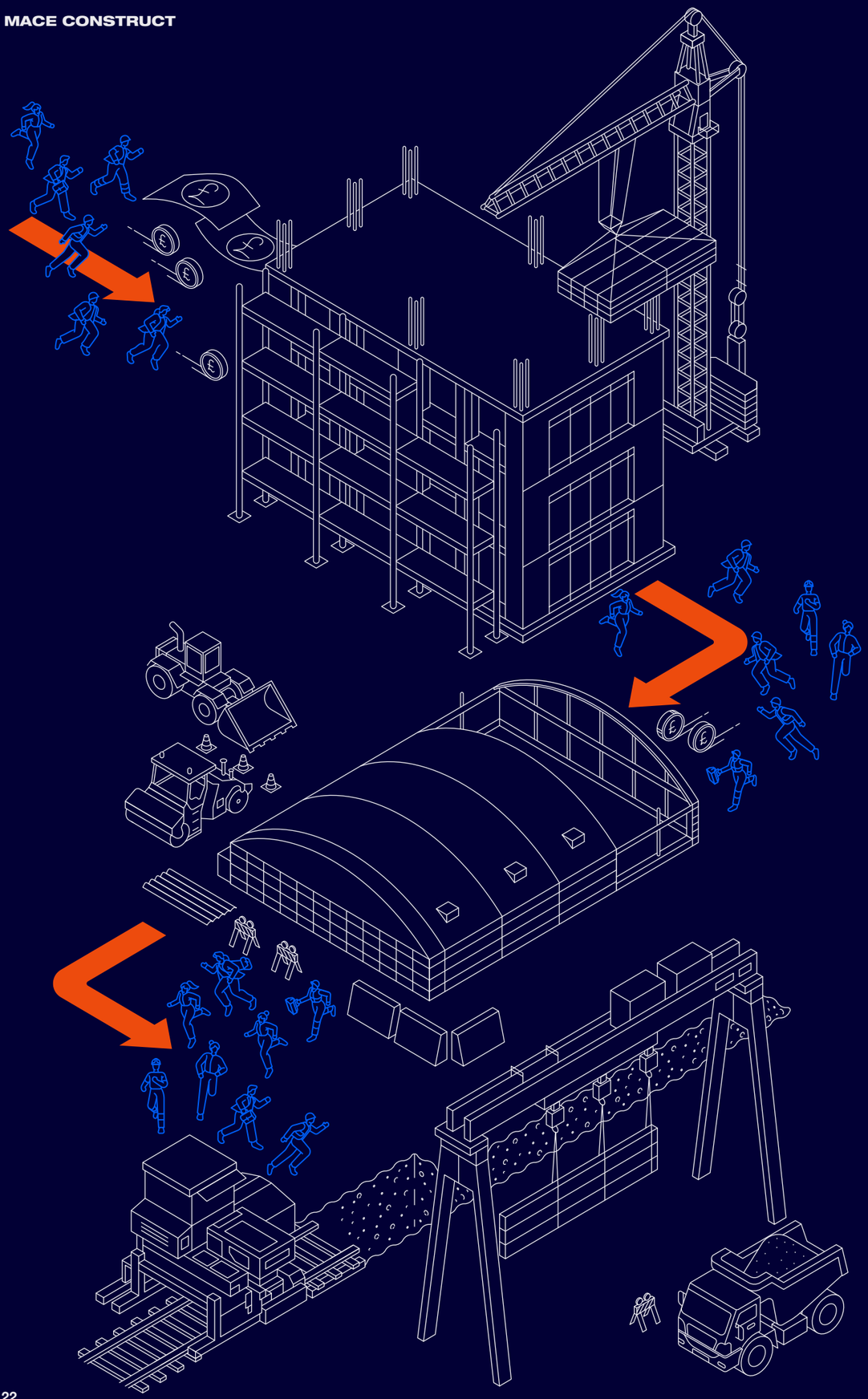
EDGE LONDON BRIDGE

EDGE London Bridge shows how construction productivity improves when performance is measured clearly and used to inform delivery. Rather than relying on assumption or retrospective reporting, the project focused on understanding how work was actually being carried out on-site, using insight to improve outcomes.

Working with the University of Cambridge and structural contractor, Morrisroe, Mace Construct introduced digitalised productivity measurement across the concrete substructure and superstructure.

Major activities including cores, slabs and pours were treated as repeatable production cycles, with data from the BIM model, programme, concrete records, labour allocation sheets and site imagery collated to compare planned and actual performance by activity and location. Time and motion analysis, regular site capture and zonal tracking helped the team understand labour deployment, and to identify where time was being lost. Measuring productivity over full construction cycles, rather than daily snapshots, gave a more reliable view of output, labour efficiency and variation between gangs and zones.

The data produced practical insight: core construction consistently achieved typical nine-day cycle times, upper-quartile wall performance exceeded 90 square metres per day, and high-performing slab zones delivered more than 60 square metres per day. As constraints were identified and addressed, sections of the superstructure progressed up to 11 weeks ahead of programme without increasing labour or plant, meanwhile 65% of labour effort remained focused on critical path activities.



WORKFORCE

Construction organises labour in a way that would be unthinkable in most other industries. Around 37% of the UK construction workforce is self-employed, against a national average of 13%,[xx] and the shift from direct employment to labour-only subcontracting was largely completed by the mid-1990s.[xxi]

Workers move between sites, between trades, and between firms with a frequency that has become one of the defining features of how the industry operates.

Mark Robinson, Group Chief Executive at SCAPE, a public sector procurement specialist, argues that main contractors today have evolved to act as management contractors with streamlined direct labour. They often rely on a constantly shifting supply chain to drive productivity as a result.

Workforce churn is not a HR issue. It is one of the core mechanisms through which the structure of the industry shapes what it delivers.

Churn vs productivity

The Mace Construct data shows how churn varies across the portfolio and how it relates to productivity. The most stable workforces are found on the long-running framework arrangements, and on collaborative contracts more generally. Teams move far less frequently on these projects than elsewhere.

At the other end of the spectrum, projects delivered under design and build contracts, particularly those with longer durations, experience much higher levels of churn. This reflects the project-by-project commercial model that dominates much of the industry. The pattern in the data matches what the interviews describe. Where Mace Construct, its clients and its supply chain have kept teams together through repeat work, framework arrangements and collaborative procurement, churn is lower. Where commercial structures encourage a more transactional approach to labour, workforces fragment.

A threshold effect

Workforce churn does not affect all projects equally. On sites with fewer than around 250 operatives, some movement of workers is expected as projects progress through different phases, and the data shows no meaningful productivity penalty associated with this. Above that threshold, the penalty becomes measurable and grows with scale.

On a site with around 500 operatives, moving from a stable workforce to a high-churn one is associated with roughly 8% lower GVA per hour. At 750 operatives, the gap widens to around 12%. And because the proportional effect grows with project size, larger sites take a double hit: per-worker productivity declines faster under high churn, and the decline is felt across a bigger workforce. Larger sites also face the challenge of more complex on-site workforce logistics and longer times to actually reach specific work areas within the site.

“We like to keep good teams together and where there’s continuity of work with a secured pipeline, we can do that. Reducing churn improves predictability, on programme delivery and safety performance.”

John Shealy,
Operations Director, Morrisroe

CASE STUDY

TIMBER SQUARE

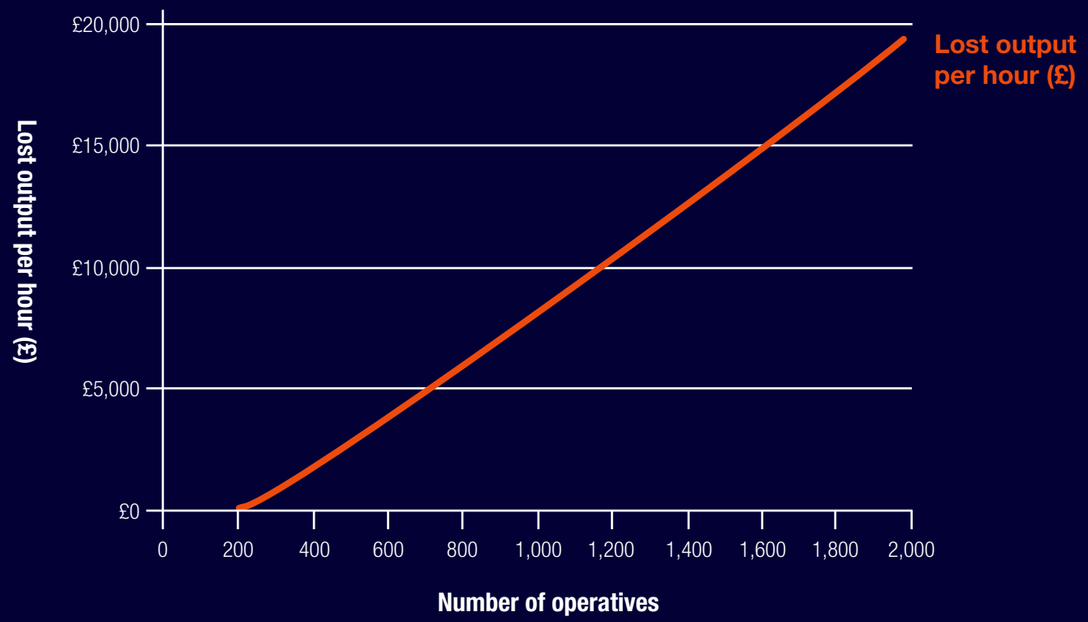
Timber Square provided a rare opportunity to examine construction productivity in detail, in real time, on a large and complex London commercial development. Delivered under a construction management contract for Landsec, the project comprises two buildings constructed concurrently using a hybrid steel and CLT superstructure, and sharing critical lifting and logistics infrastructure.

Rather than relying on anecdotal assessments of performance, the team worked with the Construction Productivity Taskforce and the University of Cambridge to digitally capture, measure and analyse productivity on the superstructure works. Crane cameras, telematics, site access data and installation tracking tools created a granular picture of how value was being created on-site, and where it was being lost. The findings showed that productivity was shaped less by the number of people on-site and more by how effectively work was sequenced, packaged and supplied. Although overall production rates were constrained by shared craneage, weather disruption and access restrictions, labour productivity remained significantly higher than industry benchmarks. The hybrid steel and CLT system reduced the need for large concrete gangs, enabling smaller, more focused teams to install floor plates efficiently.

Crucially, the study also showed how disruption to logistics and crane utilisation had a disproportionate impact on output. Where materials arrived correctly sequenced and workfaces were clear, output improved markedly without increasing labour, demonstrating the value of designing work around flow, certainty and integration.

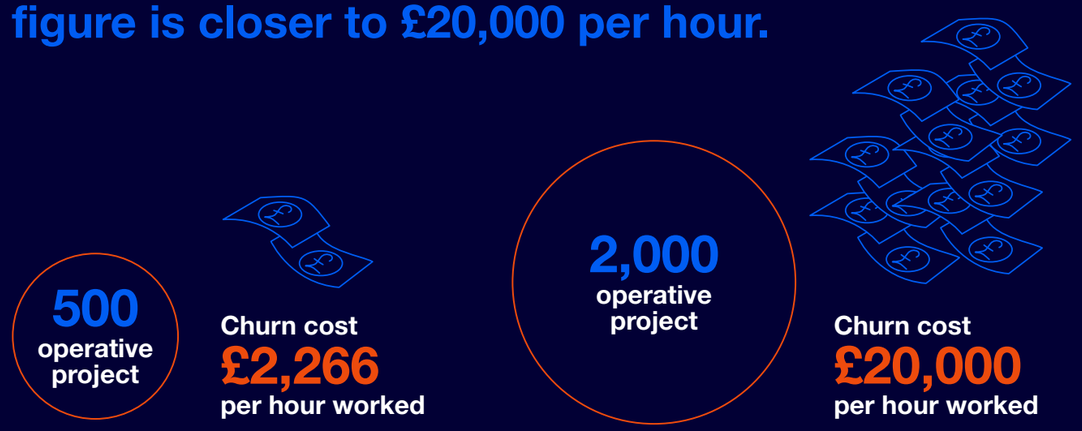
Figure 4: Lost output per hour generated by going from low to high workforce churn by project workforce size

Workforce churn doesn't have much impact on small projects, but cuts output per hour dramatically on large ones.



Source: Bradshaw Advisory analysis of Mace Construct data.

In cash terms the difference is stark. On a 500-operative project, moving from low to high churn costs around £2,266 per hour worked. On a 2,000-operative site, the figure is closer to £20,000 per hour.



Over the life of a typical 500-operative scheme running for eighteen months, that adds up to around £5 million of output lost from the same number of hours worked.

Each time a worker leaves and is replaced, time is lost to induction, to familiarisation with the site, and to rebuilding the working relationships that allow teams to operate efficiently. On smaller projects, the effect is absorbed. On larger sites with dozens of trade interfaces, it compounds.

The conditions under which work is carried out also play a role. Poor site logistics and inadequate welfare provision increase both the likelihood and the cost of workforce churn. On large sites, where distances are significant and coordination demands are high, workers can spend substantial amounts of time moving across site, waiting for materials or navigating poorly organised work environments. These conditions make sites less efficient to operate and less attractive to remain on, increasing the probability that workers move on and amplifying the disruption when they do.

The effect is cumulative. Where site logistics are well managed and welfare provision is sufficient and accessible, workers are able to operate more efficiently and are more likely to remain on the project. Where they are not, the time lost to movement and waiting is added to by the repeated loss of site knowledge and working relationships that churn creates.

The view month by month

The same pattern shows up within individual projects when churn and productivity are tracked month by month. Workforces that fluctuate more from month to month deliver less per hour, and the effect is again stronger on larger projects.

The monthly view also reveals something the project-level analysis cannot. Workforce disruption in a given month tends to show up in the productivity data a few months later, rather than immediately. This is consistent with the practical reality that new arrivals need time to learn their way around the job, the team and the programme before the cost of their unfamiliarity is fully felt.

Scaling up

The NISTA infrastructure pipeline implies demand for an average of more than...

337,000

skilled site workers per year over the next five years, with the greatest pressures in energy, transport and water.[xxii]

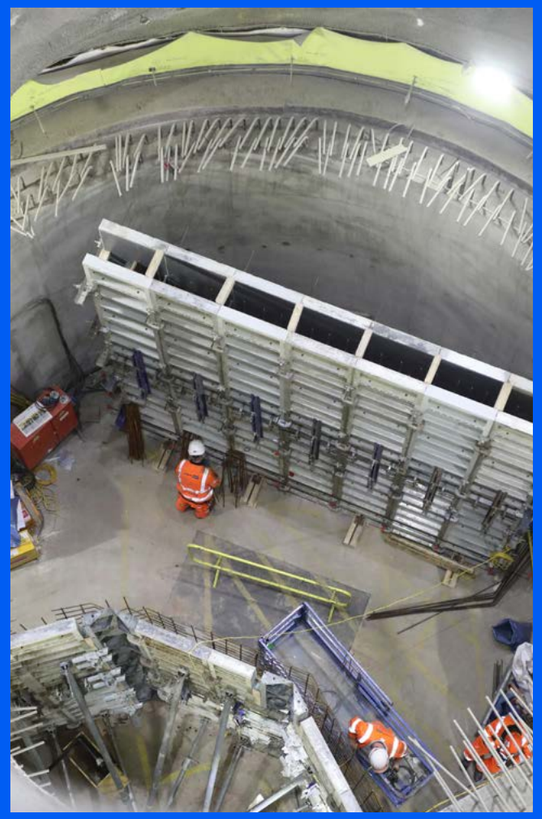
These are exactly the kinds of large, interface-heavy projects where the churn penalty is most severe.

Scaled across that future pipeline, the difference between delivering it under high-churn and low-churn operating conditions works out at around...

£1.3bn

a year in lost output, equivalent to the work of roughly 26,000 workers.

This is an indicative estimate, not a precise forecast. But in a sector already facing hard labour constraints, it is not a marginal effect. It is the equivalent of losing a sizable share of the workforce the industry is relying on to deliver its infrastructure ambitions.



CASE STUDY

HS2/ EUSTON

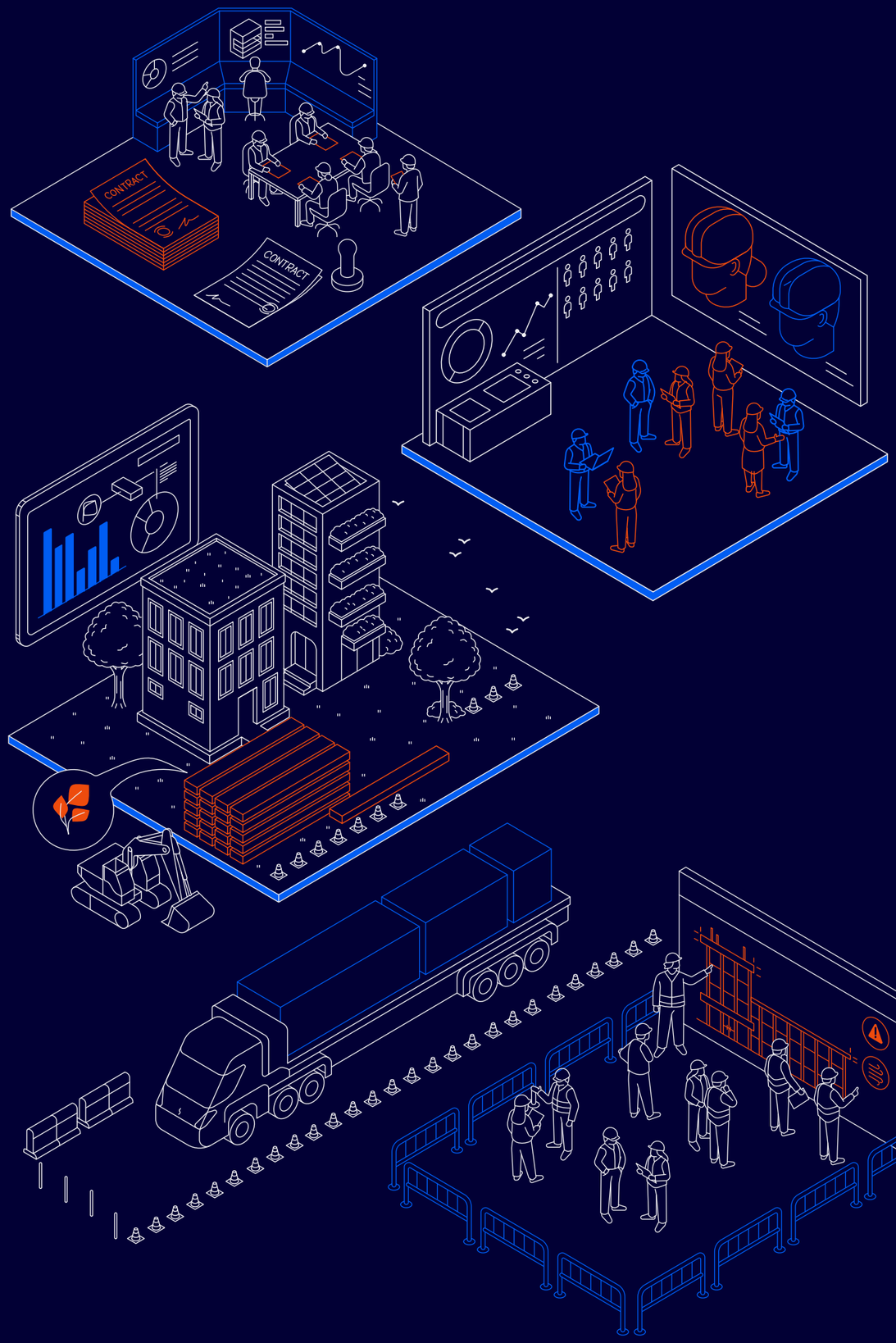
The new high-speed station at Euston is one of the most complex construction sites in the UK. The station brings together high-speed, classic and underground rail within a tightly constrained central London footprint. At its peak, more than 3,000 people from 30+ specialist subcontractors will work across the site, often in close proximity and across multiple levels.

In that environment, productivity depends on coordination. Traditional spreadsheet-based planning could not cope with the scale, pace or interdependence of activities, leading to fragmented visibility and unreliable handovers between trades.

Working within the Mace Dragados Joint Venture, the team adopted a disciplined short-term planning approach, using Aphex as the digital backbone of their Production Control framework, integrated with the Sansat visualisation platform. Aphex became the single place for Level 5 look-ahead planning, replacing disconnected plans with one shared view of upcoming work. Rolling 12-week look-aheads, daily activity briefings, and weekly coordination meetings are driven from the live plan.

Responsibility for planning sits with the supply chain, but plans are reviewed and locked through a structured approval process. Work that is not planned does not proceed. This improves coordination, surfaces constraints earlier and reduces clashes between packages.

HS2 Euston shows that on major infrastructure programmes, productivity is created by planning discipline and trust in the plan, not by pushing harder in already constrained conditions.



THE SYSTEMS BEHIND PRODUCTIVITY

Productivity is shaped by more than how work is delivered on site. Contracting, workforce structure, labour availability, sustainability requirements and safety all influence how projects are set up and how effectively they perform. Together, they form the system within which construction operates.

CONTRACTING

How a project is procured is one of the few productivity levers that sits primarily with the client rather than the contractor. Decisions about when a contractor is brought in, the stage at which price is agreed – often at RIBA Stage 3 – the extent of contractor design responsibility, and the commercial terms set before delivery, all shape how the project performs. The data shows that these decisions matter more as projects get larger.

In practice, risk is often pushed down the supply chain through contract terms. On more complex projects, that risk rarely disappears. It tends to come back later in the programme, usually as delay, rework or additional cost, and with less control than if it had been managed earlier.

Clients also influence productivity through decisions that sit outside the main contract. Pre-procuring specialist packages such as cladding, MEP (mechanical, electrical, and plumbing) or lifts is common, often to secure price certainty or retain control. The unintended consequence is that the main contractor must manage interfaces it did not design, between packages it did not procure, on a programme it is still expected to deliver. That adds coordination complexity and is a direct way productivity is lost on complex projects, even though the cause sits in procurement.

On smaller projects, the contracting model makes little observable difference to productivity outcomes. Projects delivered on a fixed-price design-and-build basis perform broadly similarly to those delivered through two-stage or negotiated arrangements. On the kind of straightforward, quick-turnaround work where most of the requirements are clear from the start, the commercial model is not the dominant factor.

One of the less visible ways that procurement affects productivity is through the stage at which design is actually complete when prices are agreed. On many large schemes, the contractor is asked to price at RIBA Stage 3 or early Stage 4 against a design that is still substantially incomplete. The gap is filled by the contractor's design portion, CDP, which on MEP-heavy projects can represent a large share of the total scope. Critical elements of services design are then finalised during Stage 4 and 5, deep into the construction programme, by which point the window for off-site manufacture and prefabrication has closed.

Components that could have been factory-built if the design had been resolved six months earlier, end up being built on-site, in sequence, under programme pressure. The productivity cost of this is rarely quantified but it is structural. Late design completion removes the option of industrialised delivery and locks the project into exactly the kind of trade-sequenced, coordination-heavy site work that the rest of this report identifies as the least productive way of building.

On larger projects, the picture changes sharply. Large schemes delivered through early-involvement contracting, such as two-stage tenders or pre-construction services agreements, retain substantially more of their forecast margin than large schemes tendered single-stage on a fixed price against a finished design. The gap is around one and a half percentage points of bid value.

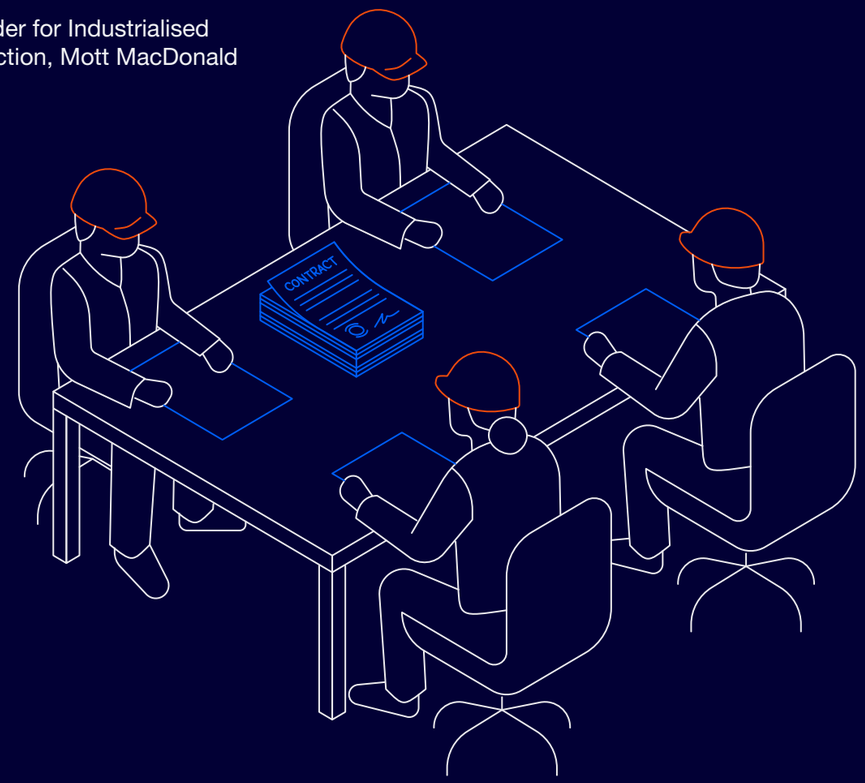
Two thirds of construction management projects in the dataset are new build, and the construction management sample includes the single largest scheme in the entire portfolio.

The coordination demands on these projects are of a different order from the rest of the book. The margin erosion the data shows is at least partly a reflection of the kind of work construction management is asked to do, rather than of how well it is done. Therefore, we weren't able to glean any robust insights from the data on construction management productivity measures.

The interviews explain why the difference impacts complex work and not simpler jobs. Design-and-build tendering is structurally misaligned on complex projects, with some contractors promising much at tender stage, then coming back post-PCSA with repricing packages that can differ by tens of millions, forcing long renegotiations and eroding trust.

"Contractors go out of business for signing bad contracts, not for building bad buildings."

Ben Carlisle,
Global Practice Leader for Industrialised Design and Construction, Mott MacDonald



The gap between what is tendered and what can actually be delivered only becomes visible on jobs complicated enough for things to change during delivery. Small projects finish before those dynamics accumulate; on large ones they can snowball.

This has a direct connection to the rest of the report. The techniques most closely associated with better productivity: MMC, digital coordination, stable workforces, are concentrated on complex projects, and they are also the techniques most dependent on early commitment and collaborative working relationships.

By the time a contractor has been procured single-stage on a fixed price against a finished design, the window for the design-stage decisions that drive productivity has effectively closed. The commercial structure determines whether those decisions are still on the table when the contractor arrives, or whether they have already been made without them.

CASE STUDY

40 LEADENHALL

40 Leadenhall is a £465m commercial development delivering more than 900,000 sq ft of office and retail space across two towers in the City of London. Rising to 34 storeys above a constrained site, the project demanded early certainty on building services to protect productivity and programme performance. Mace Construct responded with a vertically integrated MEP delivery model. A £130m MEP package was self-delivered through Mace Construct Specialist Services.

The MEP team utilised their in-house pre-construction model 'PCSA+' allowing them to be fully integrated with the design and construction teams at Stage 3 and beyond. PCSA+ is a unique pre-construction model that allows our engineering and construction modelling to run parallel to the building services design. This enhanced the collaboration with WSP, providing a fully integrated design and engineering solution encompassing enhanced CDP input and DfMA. This integrated approach removes layers of risk from the design whilst eliminating pre-construction re-work, and simultaneously providing commercial and programme benefits.

Engineers, digital specialists and supply chain partners worked to a Construction to Production approach, designing systems for manufacture and assembly. More than 1,700 MEP sub-assemblies, including modular plant rooms and riser elements, were manufactured off site. This saved 177,510 labour hours, reduced waste by 75% and cut embodied carbon by 20%, while gross value added per operative increased by 200% compared with traditional methods. Modular solutions also reduced installation on one critical section from 20 weeks to 13, while early digital modelling improved coordination by 60% and reduced defects by 85%.

THE LABOUR CONSTRAINT

The UK construction sector needs an additional 250,000 workers by 2027 according to CITB projections. The NISTA pipeline implies demand for more than 337,000 skilled site workers per year over the next five years.[xvii]

At the same time, an estimated 400,000 workers are approaching retirement. This is the tightest labour market the industry has faced in decades, and the pipeline ahead will require a workforce significantly larger than the one currently available.

The composition of that workforce makes the challenge harder. Around 37% of construction workers are self-employed, roughly three times the national average. Women account for around 4% of on-site operative hours in the Mace Construct data, broadly consistent with industry estimates for site-based trades. An industry configured this way – drawing its on-site workforce from a narrow slice of the working-age population, with limited direct employment and 400,000 retirements on the horizon – is not well placed to deliver a £700 billion pipeline.

Mace Construct's own position is stronger than the industry average.

Project teams are around...

27%

female across the portfolio.

On the Heathrow framework that figure rises to around...

30%

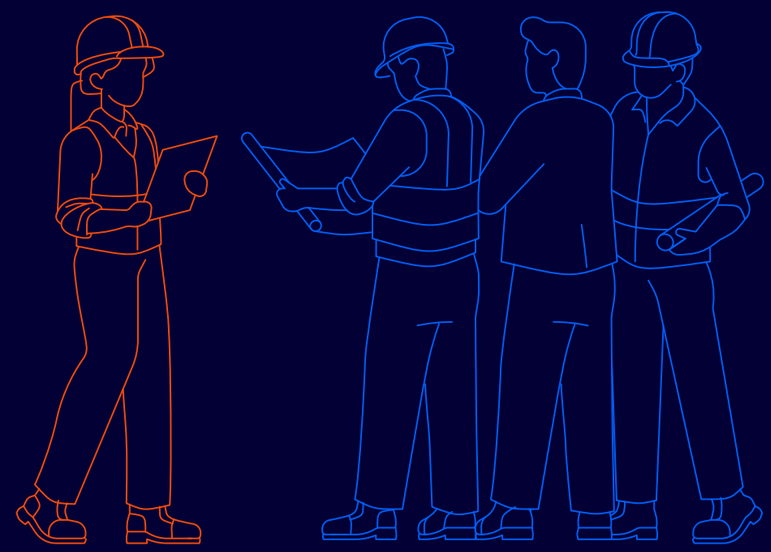
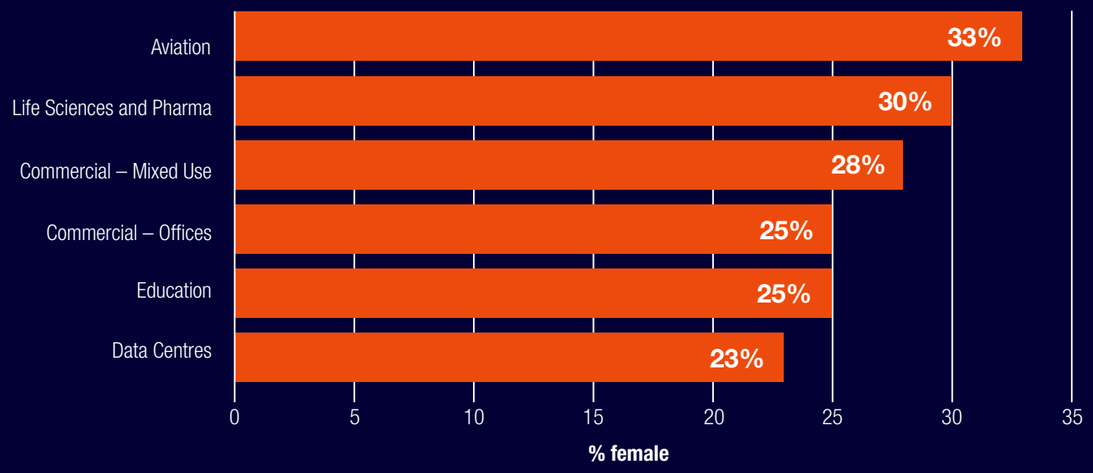


Figure 5: Average female share of Mace Construct project teams, by sector

Aviation work has the strongest gender balance in Mace Construct's project teams.

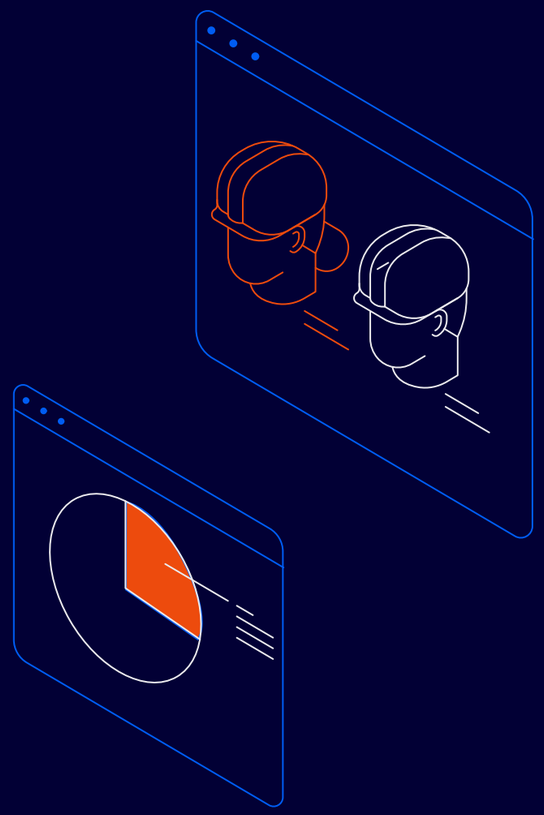


Source: Bradshaw Advisory analysis of Mace Construct data.

Across other sectors, team gender balance sits in the mid-twenties. This places the project-team side of the business ahead of much of the sector, where female representation in many firms and trades sits well below 10%. The on-site operative workforce, which is largely subcontracted labour rather than Mace Construct's own employees, reflects the wider industry picture.

Projects with more gender-balanced Mace Construct teams are concentrated in the same long-term framework and collaborative contracting environments that the rest of this report identifies as productivity-positive. The relationship is not causal, but it is consistent: stable, well-commissioned projects tend to have better workforce composition and better productivity for overlapping reasons.

The barriers to broadening the on-site workforce are well documented: working conditions, site culture, recruitment practices, the structure of self-employment itself. They have changed slowly. They are also more tractable than the alternatives the industry has relied on, which are an ageing workforce and increasingly constrained migration. Every percentage point the industry adds to its female on-site workforce is a percentage point of additional labour supply at a moment when supply is the binding constraint.



SUSTAINABILITY

While carbon data across the portfolio is still developing, the analysis highlights a clear and consistent pattern. The levers most strongly associated with better productivity are also those that reduce waste, inefficiency and embodied carbon.

Off-site manufacturing reduces on-site waste and repeated deliveries. Digital coordination reduces rework and abortive work. Stable workforces reduce errors associated with unfamiliar teams. Early contractor involvement shapes design decisions at a point where both productivity and carbon outcomes are still open. In practice, these are closely aligned rather than competing objectives.

Bernhard Dachs of Mitsubishi Estate points to early brief clarity as the key to navigating sustainability requirements at planning: the developers who move fastest are those who align their team around the carbon and retention constraints from the outset, before a single design hour is wasted going in the wrong direction.

As low-carbon expectations continue to tighten, sustainability is increasingly treated as a core constraint that needs to be designed in early, alongside cost, programme and performance.

Projects that do this well tend to avoid late-stage redesign, reduce rework and deliver more predictable outcomes.

However, sustainability is not only a question of emissions and materials. Climate change is becoming a direct operational constraint on construction productivity. More frequent heatwaves, high winds, and heavy rainfall have immediate implications for delivery. High winds can stop craneage and lifting; heavy rain and flooding can restrict access, disrupt earthworks and delay logistics; heatwaves can reduce safe working windows, increase fatigue risk and lower output per hour on high-exertion site activities.

These impacts also compound, not just through lost hours, but through disrupted sequencing, increased waiting time and re-planning, greater rework risk, and poorer working conditions that can accelerate workforce churn. The implication is that resilience measures – better temporary works and drainage planning, logistics protection, heat mitigation, and a greater shift to off-site manufacture to reduce exposure to weather-sensitive work – are increasingly both a sustainability strategy and a productivity strategy.

A consistent theme across our findings is that productivity and sustainability improve together when projects are well structured. Where decisions are made earlier, design is more complete and delivery is better coordinated, both outcomes tend to follow.

Without consistent, comparable data on environmental performance alongside commercial and productivity data, the sector cannot learn what is working. The absence of definitive conclusions in this report reflects that gap, and points to the need for better measurement rather than weaker underlying alignment.

SAFETY

Safety is, naturally, a standard part of operational activity across Mace Construct's work.

The company's wider safety dataset covers more than 300 projects and over two hundred million staff hours. Across these it has recorded more than half a million safety observations, thousands of near misses and first aid cases, and a smaller number of more serious incidents. Site management time spent on safety activity is now a meaningful share of the total.

When it comes to safety and building safety no one interviewed for this report questioned whether improvements should continue. The Grenfell Tower tragedy showed that a cultural and behavioural shift was necessary. However, a number of interviewees felt that the way safety is now implemented often adds friction without obviously adding substantive value to safety. Nick Abbey of Mace Construct captured the tension directly: the Building Safety Act was an embarrassment to the industry that we needed it to make us do what we should have been doing anyway, but the administrative burden it has brought is real.

Building Safety Act documentation, governance gateways and fire-testing protocols are consistently cited as adding time and cost in ways that often do not map cleanly onto beneficial outcomes and safety improvements on the ground.[xxiii] Many interviewees felt the current implementation and operation of the Building Safety Act was a system-level productivity constraint.

There is a direct connection between the findings elsewhere in this report and safety outcomes. Moving work off-site into controlled factory environments removes workers from many of the highest-risk site activities — working at height, heavy lifting, hot works, confined spaces. The same shift toward off-site manufacturing that the MMC evidence shows improving commercial productivity also reduces the volume of hazardous on-site activity. Robotics point in the same direction: the tasks most suited to robotic adoption (rebar tying, bricklaying, demolition, heavy logistics handling) are also among the most physically dangerous. The productivity case and the safety case for both technologies overlap substantially.

Another interviewee made a connected observation about measurement. Health and safety, building regulations and similar compliance activities add what he calls non-productive hours that do not directly show up as output. In an industry where productivity is measured from the value delivered rather than from the total activity undertaken, a growing share of real work is now invisible to the headline statistics. Compliance hours are real work, and they contribute to the ONS-measured decline in construction productivity without reflecting any change in what is being built or how well.

Within the subset of projects where the safety data can be matched to productivity outcomes, there is no clean correlation between the two. The projects that manage health and safety well tend to be the same projects that manage everything else well. Long-term framework arrangements, stable crews, collaborative contracting and experienced client relationships produce better safety outcomes and better productivity outcomes at the same time, for overlapping reasons.

The Heathrow framework is the clearest example. Injury rates on the Heathrow projects are substantially lower than on the rest of the portfolio, alongside the higher workforce stability, better gender balance and stronger commercial outcomes that earlier sections of this report have already identified. The same structural conditions – stable teams, long-term client relationships, collaborative contracting, repeated delivery of similar work – produce better outcomes across almost every dimension at once.

The implication is that safety and productivity should not be treated as competing priorities. The interventions this report identifies as productivity-improving are also the interventions that produce safer sites. A site with fewer workers doing less hazardous work in better-coordinated conditions is both more productive and safer. The trade-off the industry sometimes perceives between getting things done quickly and getting them done safely is, on the evidence here, largely false.

CASE STUDY

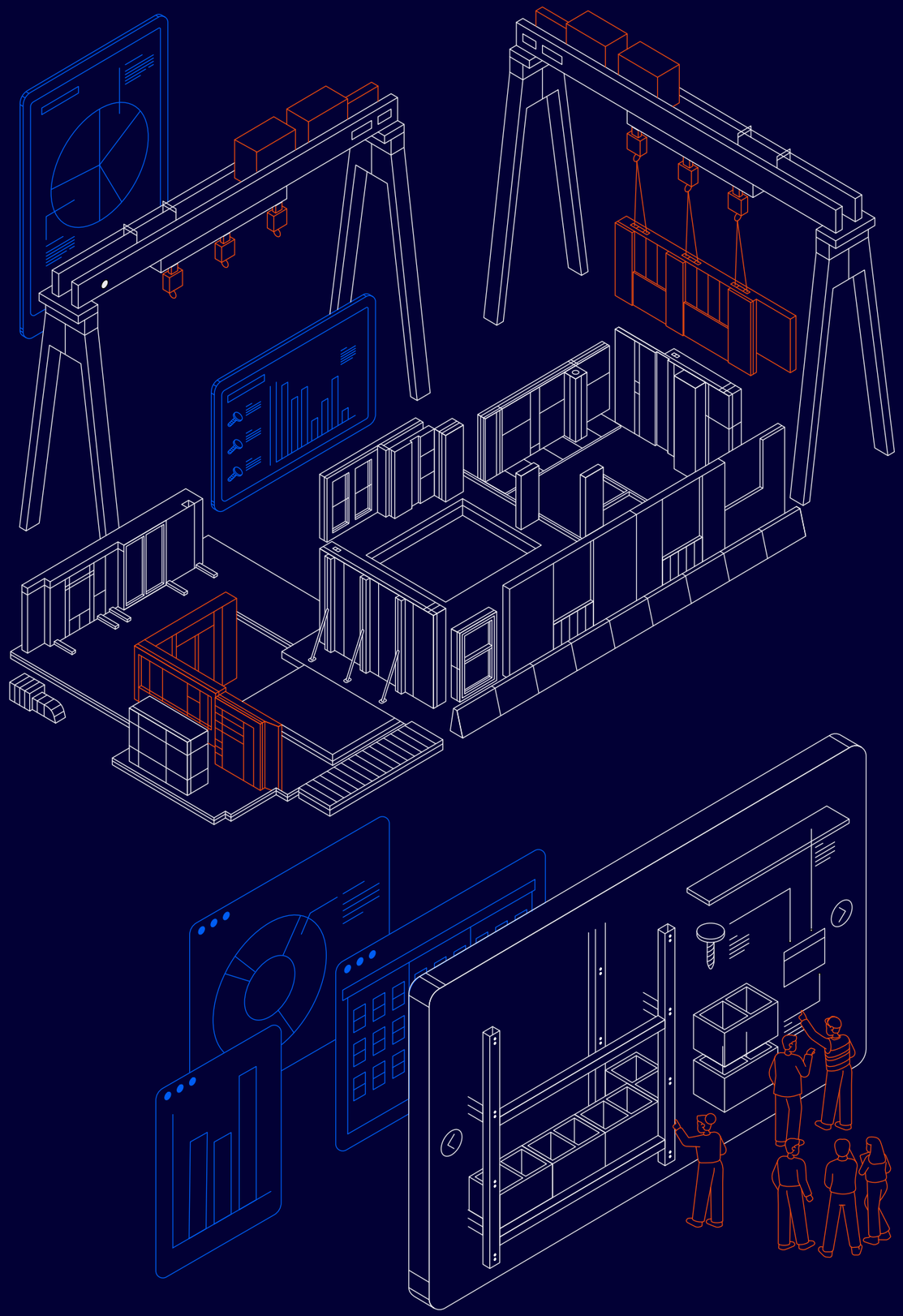
HEATHROW CARGO TUNNEL

The Heathrow Cargo Tunnel refurbishment was delivered in one of the UK's most operationally constrained environments. The 870-metre tunnel is a live, safety-critical asset operating 24/7 beneath active taxiways and the southern runway, with works restricted to a tightly controlled nightly engineering window. In this context, productivity depended on certainty, repeatability and minimising time spent by the workforce on-site.

Through early contractor involvement, the team adopted a Construction to Production strategy, redesigning the scope around standardised off-site manufactured elements. Through Mace Construct Specialist Services, 730 MEP modules were produced off-site, shifting most labour-intensive activity into controlled factory environments and enabling rapid, predictable installation within the five-hour nightly window while keeping the tunnel operational.

Average output per labour hour was almost double the aviation framework average, while pre-manufactured solutions accounted for around 88% of prime cost. The approach also reduced the programme from a traditional 199 weeks to 135 weeks. Digital delivery underpinned the model, with BIM-enabled tag-and-track manufacturing, live production data and 4D rehearsals optimising installation before work reached site.

Robotics and laser scanning reduced manual surveys, preventing rework. Off-site manufacture also contributed to 5,000,000 $kgCO_2e$ of carbon savings, showing how productivity and environmental performance can improve together.



INDUSTRIALISED AUTOMATED CONSTRUCTION

Modern methods and digital tools are not separate solutions. Together, they determine how efficiently construction is delivered and how much of that work translates into real value.

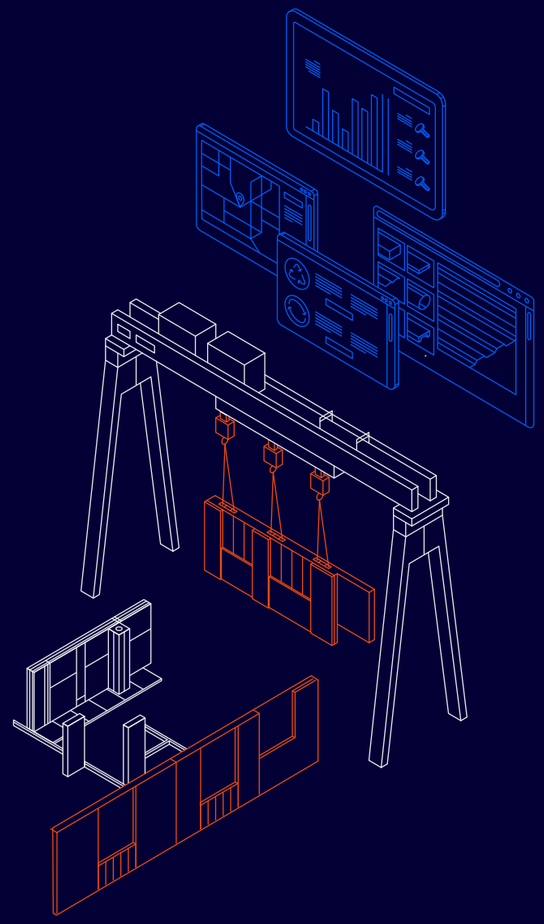
The exploratory analysis established that a project can score well on one measure of productivity and poorly on another. Projects that convert labour hours into output efficiently with high GVA per hour, are no more likely than any other to retain their commercial margin.

Hourly output and commercial productivity are, in this portfolio, essentially independent. The interventions most often sold as productivity improvements, MMC and digital adoption, do not show up where the industry tends to assume they do.

Neither MMC nor digital maturity is associated with higher GVA per hour in the Mace Construct data. Where they show up is on the commercial measures: gross contribution per worker for MMC, margin retention for digital. Both interventions, in other words, affect what share of the labour going into a project ends up translating into commercial value, not how much physical work gets done per hour on-site. It can also increase the predictability of delivery for clients.

Clients also need to be aware of the cash flow constraints that need to be addressed when moving to an off-site industrialised approach. The reality is that upfront payment is required from the client directly to the MMC provider, as neither the main contractor nor subcontractors can cover these costs themselves.

The ‘Get It Right Initiative’ estimates that errors and rework alone cost the construction industry around twenty pence in every pound.[xxiv] It is at that end of the pipeline, the loss of value between work performed and value retained, that MMC and digital appear to have the strongest effect.



“We take relatively cheap materials and repeatedly handle them using craft-intensive labour in temporary, one-off organisations. It’s not a very efficient model and there has to be a better way.”

Ben Carlisle,
Global Practice Leader for Industrialised Design and Construction, Mott MacDonald

CASE STUDY

MANCHESTER AIRPORT

TERMINAL 2, PIER 2, PHASE 2

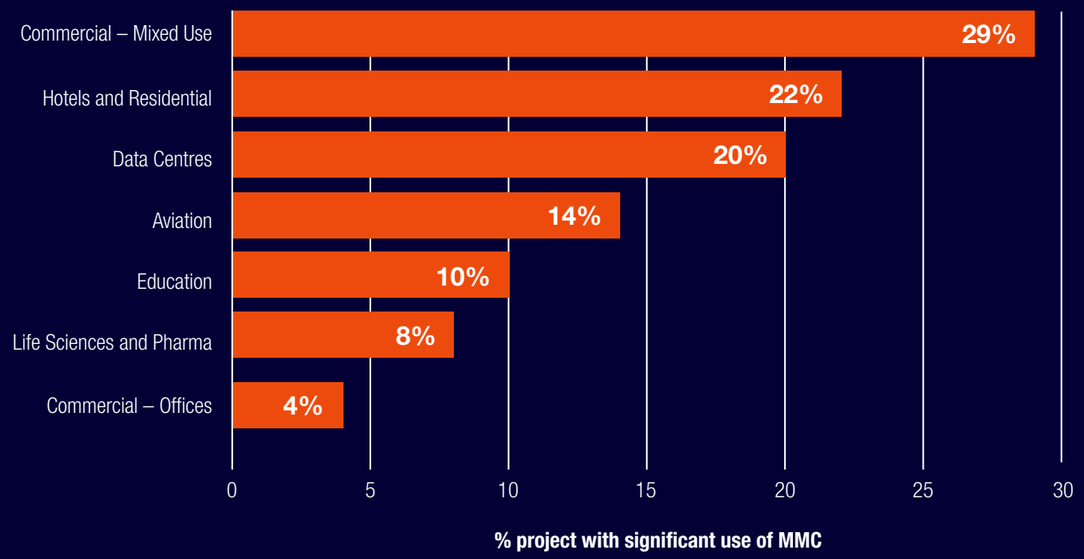
Manchester Airport’s Terminal 2 transformation programme shows how productivity improves when complex infrastructure is designed and delivered as a repeatable system. Working in a live airport environment, Mace Construct focused on reducing on-site complexity by standardising design, increasing off-site manufacture and simplifying installation.

For Pier 2 Phase 2, Mace Construct worked with WSP to develop a kit-of-parts approach for fixed links and nodes connecting the pier to the terminal. Instead of bespoke structures, these elements were designed as standardised components that could be manufactured, assembled and installed in a predictable sequence. The approach reduced the number of individual components from the thousands to under a hundred sub-assemblies, and made them repeatable, simplifying procurement and reducing interfaces on site. Around 80% of construction activity was under factory conditions, removing thousands of hours of work from the live airside environment, improving efficiency, safety and quality. Nodes that would traditionally take months to build on site were assembled within weeks, with more than 5,400 personnel hours delivered off site.

Gross value added per operative hour increased to £399 compared with around £150 using traditional methods, while around 79,000 fewer operative movements were needed airside. The reusable kit of parts can now support faster mobilisation and more predictable future airport schemes

Figure 6: Share of projects with significant use of MMC by project type

Where modern methods are used is not a random choice.



Source: Bradshaw Advisory analysis of Mace Construct data.

Modern methods of construction

MMC are not evenly distributed across the portfolio. The Mace Construct data flags projects by their pre-manufactured value content, the share of the build delivered through off-site manufacture, as the available proxy for how far MMC has been used on a given scheme. On that measure, MMC is clustered on a particular kind of project: larger, longer-running, higher-value schemes, with a median bid value of around £74 million against £23 million for the rest of the portfolio. It is concentrated in new build and major infrastructure, and essentially absent from fit-out and interiors work.

That concentration is not random. MMC is a design-stage commitment that pays off over longer schedules with repeatable components, and the projects where those conditions apply are disproportionately the larger, longer, new-build and infrastructure schemes.[xxv] Any comparison between high-MMC and low-MMC projects therefore has to hold project type roughly constant, otherwise the comparison is really between two different kinds of project.

Once that adjustment is made, the conclusion is clear. High-MMC projects generate around 50% more commercial value per worker than comparable projects of similar size and type. Workers on these sites are not producing more output per hour. What changes is how much of their work ends up contributing to commercial value rather than being absorbed by coordination failures, clashes and rework, which is exactly what off-site manufacturing, done well, is supposed to achieve.

The interviews add important texture. Tim Carey, Head of Design at Mace Construct cautions that pre-manufactured value is an input, not an output: a project can drive its pre-manufactured value (PMV) number up by making expensive design choices without becoming any more productive. Nick Abbey, an Operations Director in Mace Construct also notes that the industry is still learning how to execute off-site at scale, and the decision has to be made early. By RIBA stage 2 or 3, the option has effectively closed. Where modern methods deliver, they deliver because they were designed in from the start.

CASE STUDY

TWO BUILDINGS, ONE CITY, DIFFERENT OUTCOMES

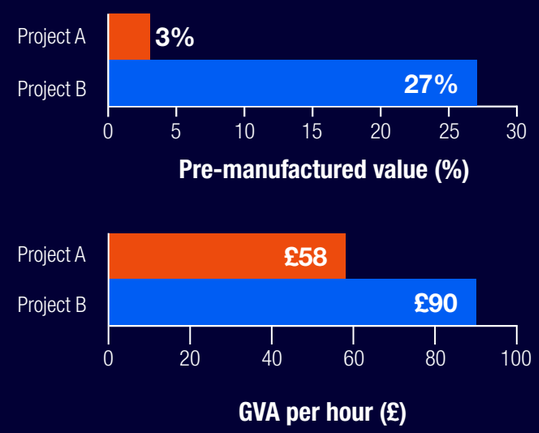
The portfolio offers a useful natural comparison between two London commercial new-build projects of almost identical scale but very different approaches to off-site manufacturing.

Project A had a bid value of around £130 million and very low pre-manufactured value content, around 3%. The project ran for 66 months and generated GVA of around £58 per hour worked.

Project B had a bid value of around £125 million and pre-manufactured value content of around 27%. The project ran for 59 months and generated GVA of around £90 per hour worked, more than 50% higher than Project A across an otherwise comparable scheme. Project B also delivered substantially stronger commercial value per worker.

Figure 7: Comparison of PMV and GVA between two London Projects

Project B, with nine times more PMV, saw 55% higher productivity than Project A.



Source: Bradshaw Advisory analysis of Mace Construct data.

Two projects of similar size, in similar markets, in similar building types, with very different productivity outcomes. The most visible structural difference between them is the share of the work that was committed to off-site manufacturing at the design stage.

The wider portfolio analysis points in the same direction, projects with higher use of MMC generate, on average, around 50% more commercial value per worker than otherwise comparable projects of similar size. Projects A and B confirm that pattern on two specific schemes that the wider portfolio analysis might otherwise leave abstract.

"Increasing PMV and embedding MMC across the lifecycle provides Heathrow with a repeatable, consistent and data-driven approach to achieving higher productivity, stronger capital efficiency, and resilient programme delivery across the £10bn H8 portfolio. This would result in 2.5m site hours saved on Heathrow estate per year, or around 1,500 fewer operatives per year needed across H8 which reduces operational pressure (welfare, security, logistics) and increases delivery certainty, quality, operational impact and safety outcomes."

Matt Randall,
Preconstruction Director, Mace Construct

CASE STUDY

HYPERSCALE DATA CENTRE PROGRAMME

This confidential multi-phase hyperscale data centre programme demonstrates how productivity improves when construction is treated as a repeatable production system rather than a series of one-off projects. Delivered across a large campus, the programme created the conditions for standardisation, learning and continuous improvement between phases.

From the outset, delivery moved away from traditional stick-built methods. Key elements were redesigned as modular and repeatable assemblies, manufactured off-site or within dedicated on-site production areas and installed as completed units. This reduced work at height, eased trade congestion and cut rework, enabling smaller teams to deliver more consistent outputs.

Productivity gains came from how work was organised and repeated over time. Lean planning routines stabilised workflows, reduced downtime between trades and improved reliability. As lessons were captured and reapplied, installation rates increased while labour and plant requirements reduced. In several work areas, output improved by more than 30% while using fewer people.

Digital delivery supported this approach by providing a single, reliable view of progress, constraints and quality. Live production data replaced assumption, allowing teams to manage performance day-to-day rather than react after the fact.

The most significant gains came from scale and repetition. By standardising solutions and applying learning across phases, the programme delivered faster, more predictable outcomes over time, showing how productivity improves cumulatively when construction is designed around production principles.

Digital approach

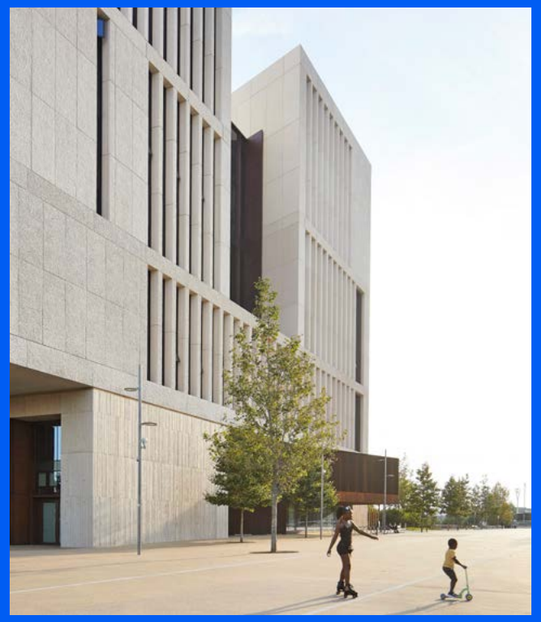
Digital tools are a different story in regards to deployment patterns. Digitally mature projects are distributed much more evenly across the portfolio than high-PMV ones. They appear across sectors and building types, from interiors and retrofit through to major infrastructure, and they do not cluster on the largest or longest-duration projects in the way MMC does. Median size is, if anything, slightly smaller than the rest of the portfolio.

However, the findings point in the same direction as MMC. On projects of similar size and building type, digitally mature schemes retain around £1 million more of their forecast margin than their less digitally mature counterparts. Again, the effect is not visible in hourly output, but in how much of the value initially bid for the project actually survives delivery.

This is not the headline that a decade of digital twin marketing might have suggested, but it fits what the people doing the work describe. Luke Ridgwell of UCL identifies clash detection and 3D coordination as the digital applications that have made the biggest practical difference, with the more ambitious twin use cases delivering far less than they promised. Dale Sinclair of WSP makes a similar point about model-first services coordination.

Others point towards the plethora of different digital tools that different contractors use. Each requiring a specific set of knowledge, onboarding and product licensing. NBS reports that two in five construction professionals now use AI tools in their daily work, but adoption remains fragmented across firms and project stages.[xxvi] This lack of standardisation generates inefficiency and sometimes confusion.

The digital tools that matter are the ones that target the practical problems of coordination, sequencing and information flow. These are the areas where work ends up wasted between the drawing and the building.



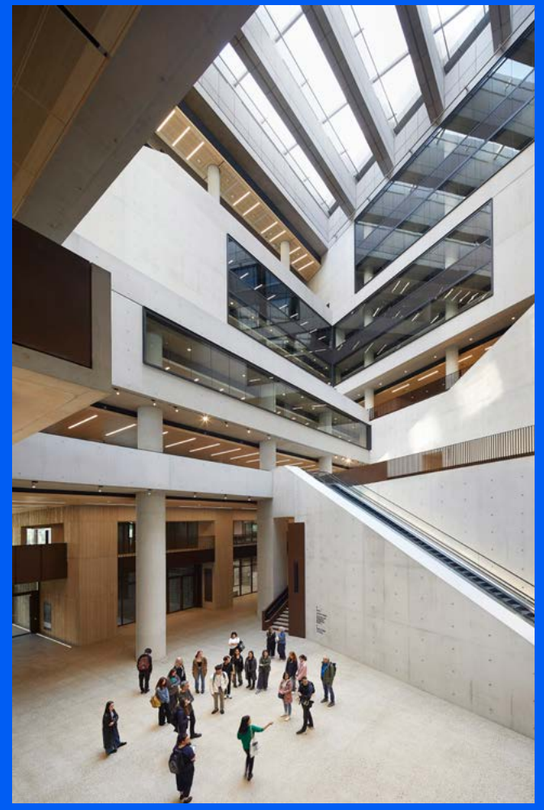
CASE STUDY

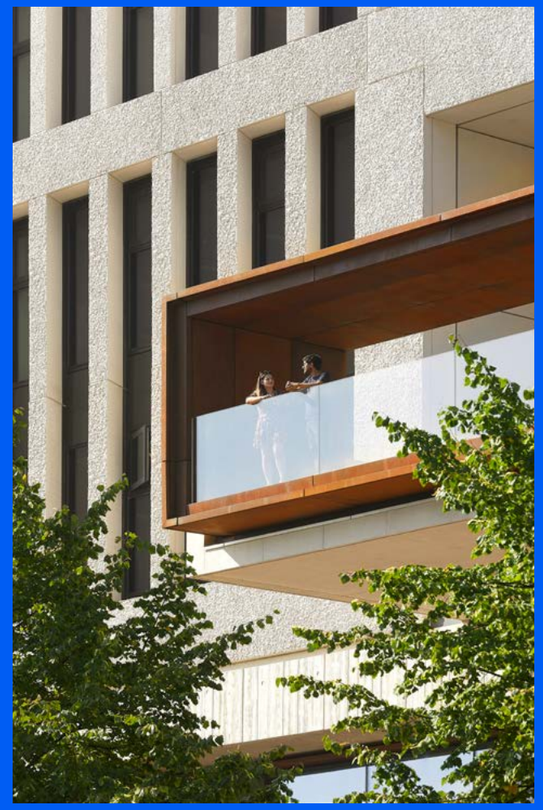
UCL EAST MARSHGATE

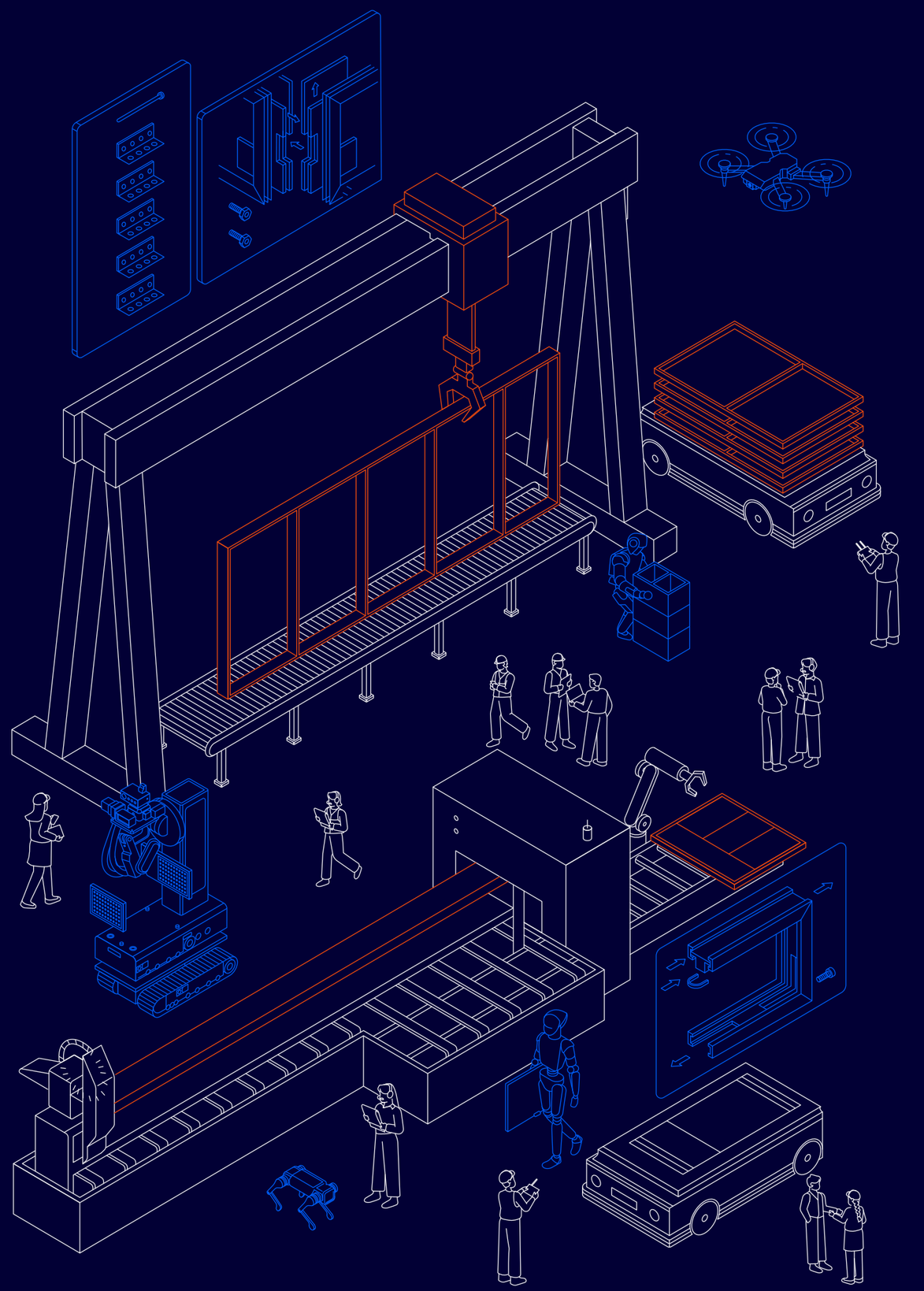
UCL East Marshgate was always going to be a demanding project. As UCL's largest building to date, it brings together teaching, research and public space across eight storeys on a tight site within the Queen Elizabeth Olympic Park. The mix of uses, interfaces and stakeholders meant the project could easily have become congested and inefficient.

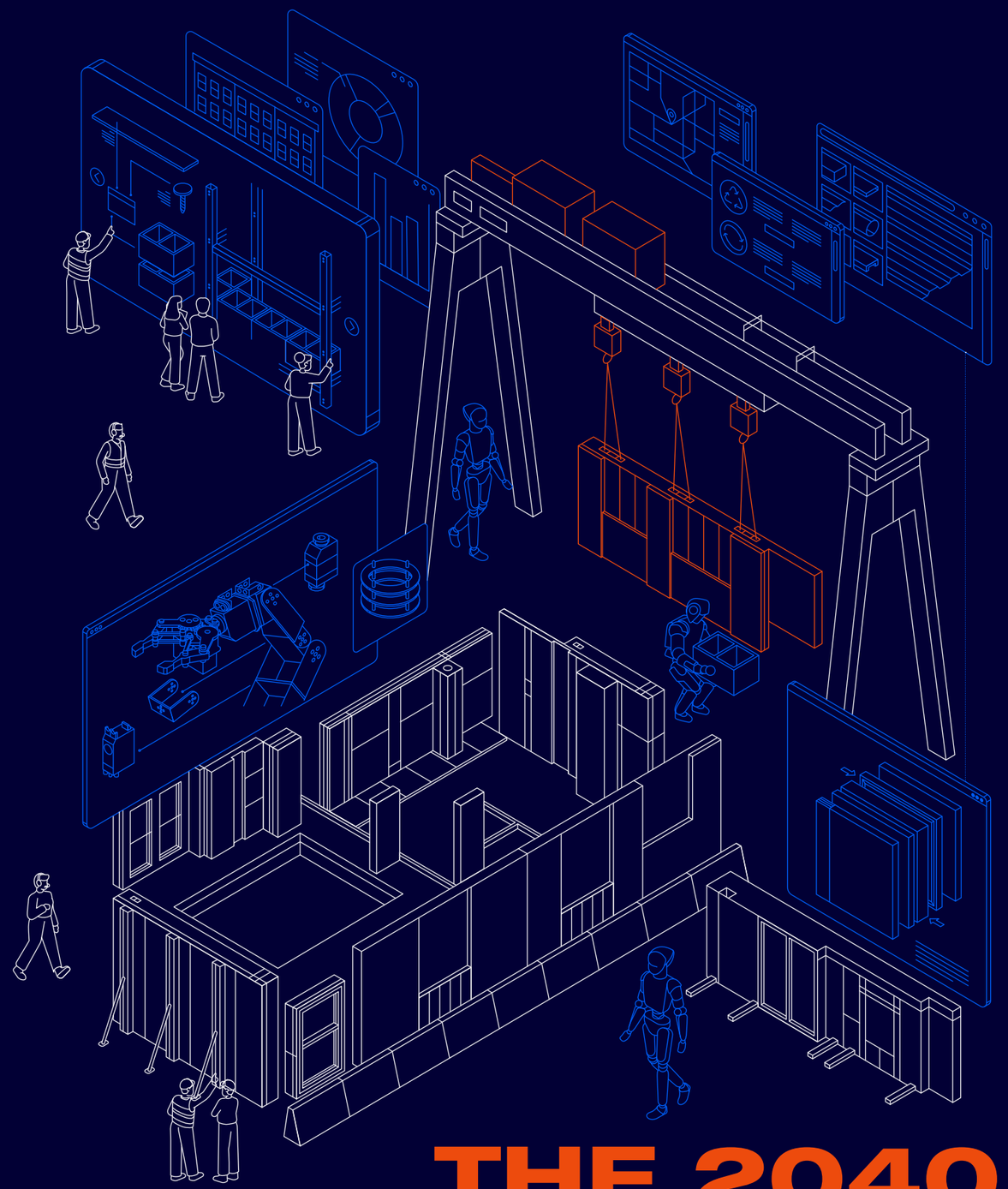
That challenge intensified during periods of Covid-related disruption, when site access, workforce availability and sequencing became less predictable, increasing the risk of waiting time, rework and lost momentum. Productivity therefore depended less on pushing harder on-site and more on making every activity count. The team responded by leaning into digital coordination and planning. Activities were sequenced earlier and with better visibility across disciplines, reducing the need for reactive problem-solving on-site, and making it possible to package tasks more intelligently.

This planning-led approach enabled increased use of on-site sub-assembly, with elements prepared away from the critical path and installed as coordinated units. That reduced trade stacking, minimised repeat visits to the same areas and improved use of limited time and space. Importantly, these gains were achieved without relying on full volumetric MMC. Instead, they came from smarter packaging, sequencing and integration on a bespoke building. The result was a more predictable site with fewer clashes, less rework and a more efficient delivery model in conditions far from business as usual.









THE 2040 CONSTRUCTION SITE

Through our own experience of schemes and investment into emergent delivery methods and technologies, we can make some guesses at what a large construction site may look like in 15 years' time.

The biggest change is likely to be where the work happens.

On the larger, more repeatable schemes – digital infrastructure, water, hospitals, schools, prisons, nuclear, grid infrastructure – a much greater share of the build will have moved off-site into controlled manufacturing environments by 2040.

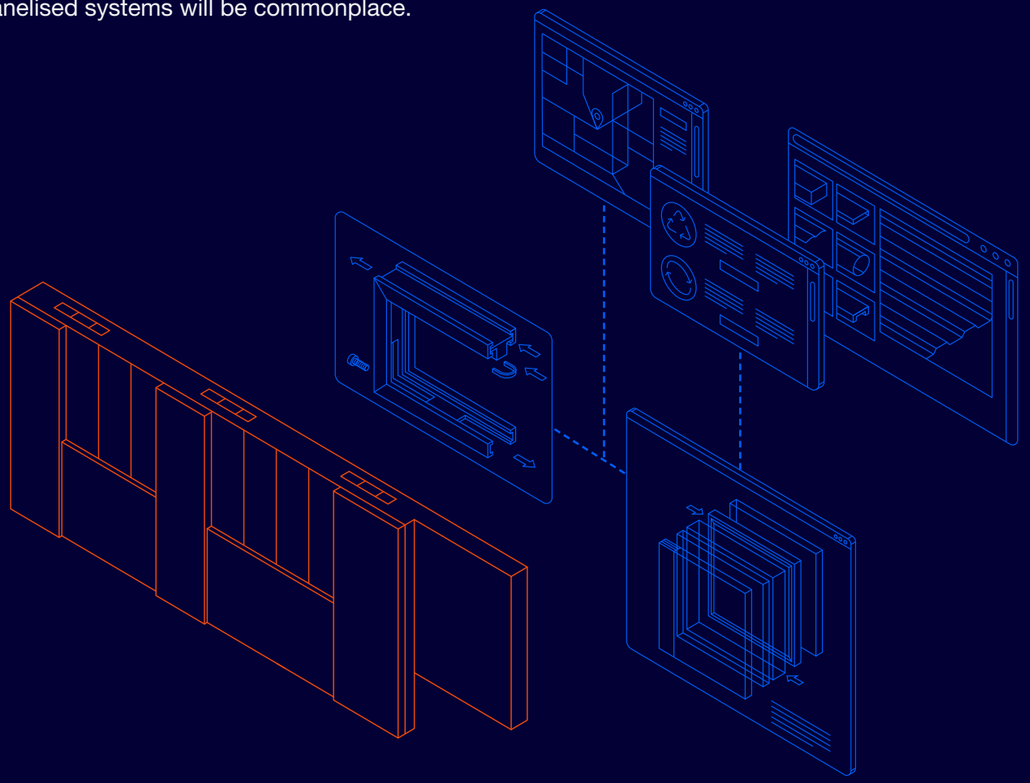
Off-site manufacture pays back when there is a repeatable pipeline to balance the capital costs against. Looking forward, the pipeline exists to do that.

Pre-manufactured value content on major schemes, which currently clusters around 25-30% on the best-performing schemes, is likely to sit closer to 50% by 2040. Volumetric modularity is likely to remain a minority approach, as the report's evidence suggests it is not likely to have widespread application. Component standardisation, consistent interfaces and panelised systems will be commonplace.

The on-site workforce will be smaller for the equivalent value of the project and differently made up.

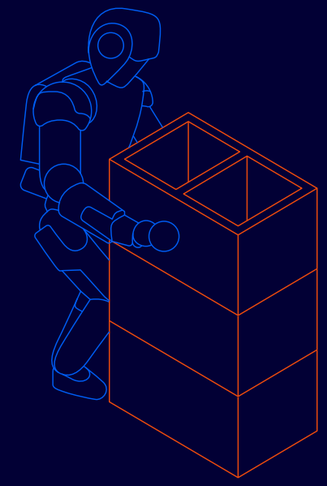
Much of the productivity gain from moving work off-site is that it converts unpredictable, weather-exposed, trade-sequenced site labour into predictable factory labour. By 2040, major sites are likely to be closer to an assembly operation than a construction operation in the traditional sense. That has implications for who works on-site, where they are trained, and on what terms they are employed.

The trades that remain on-site will be the ones that cannot be industrialised: groundworks, final fitters, services commissioning, the physical interfaces between manufactured components and the built environment.



Automation through the use of robotics should have a material role on site. Richard French, from i3D Robotics, observed that the main constraint currently is not the capability of the machines, but the tolerances of the buildings and materials they would work in which is likely to remain true for years to come.

Automation will make the biggest difference where the environment can be controlled: in the factory rather than on site, and in the narrow set of site tasks where tolerances and repetition already align with what machines do well. Layout marking, rebar tying, installing lifts, bricklaying in controlled conditions, logistics handling, demolition and inspection are the plausible use cases. Although a fully autonomous site is not likely by 2040, a site where a meaningful element of the most repetitive and physically punishing tasks has been passed to robots is.



AI is a part of the picture where potentially the gap between hype and evidence is widest. By 2040, design coordination, clash detection, programme optimisation, supply chain scheduling, compliance documentation, health and safety, and on-site progress tracking will largely be done by AI. The practical effect is that a share of the coordination or compliance work currently done manually, slowly and with errors, will be done faster and more accurately.

The design and procurement processes around projects are likely to have changed to better incorporate productivity and industrialisation considerations from the earliest RIBA stages, with the end use and 'operating brief' developed early on. This is less a technology shift than a cultural and contractual one, and it is the shift on which most of the others depend.

For Bernhard Dachs of Mitsubishi Estate, the most productive projects are built on a simple principle: transparency about cost from day one. Where contractor and client can agree on what a fair margin looks like upfront, the whole dynamic shifts – from negotiation and correction to genuine collaboration.

AI, industrialisation and automation all need early commitment to work. If the procurement environment does not change, the technology does not compound.

"Productisation is foundational – products and assemblies with defined constraints and rules to give AI a solid basis for work. AI will accelerate repetitive design elements and provide better connectivity of data across tools and processes."

Az Jasat,
Director, Industrialized Construction Strategy, Autodesk

RECOMMENDATIONS

We have seen repeated reports on how to improve productivity in construction. The last thing the industry needs is another set of recommendations that sound good but are never realised. We know what needs to change. Now we need action.

The size of the prize

If the industry follows our lead and commits to driving productivity improvements at a similar level, this could be transformational.

Based on new modelling derived from Mace Construct's project data and publicly available information, we estimate that if the construction industry were to improve productivity by 51%, we could:

Deliver...

£67bn

more in infrastructure, greater than the 2025/6 UK defence budget.

Deliver...

22,000

more homes per year, with the same budget and workforce.

Deliver the NISTA infrastructure pipeline with a third fewer workers...

113,000

per year.

Realise...

£243bn

of capital and time savings across the NISTA pipeline – the equivalent of more than two years of employers' National Insurance contributions.

At a time when the UK needs to build more with fewer workers and tighter capital budgets, improving construction productivity is a national imperative. We need to build better and smarter.

So, what is needed to achieve this?

1 Measure what is actually happening, and share it

For: contractors, clients, NISTA, ONS

This report exists because Mace Construct kept its own records and made them available. Most of the sector does not measure productivity. Avoidable losses from workforce churn alone run into the billions nationally, and none of it was visible before the data was assembled. One of the biggest drags is likely to be rework. The Get It Right Initiative estimates errors cost the industry around twenty pence in every pound of output and most firms do not track rework rates at project level at all.[xxxv]

The Construction Productivity Taskforce (CPT) has developed a seven-step framework for site measurement and a private-sector playbook for collaborative adoption should now move from voluntary to expected practice.[xxxvi]

Public-sector clients should score tenderers on whether they collect and publish project-level productivity data, as a weighted procurement criterion alongside price and programme.

Private-sector developers and funders should adopt the CPT's Private Sector Playbook as their baseline standard for productivity measurement and collaborative delivery on major schemes.

The CPT framework should produce an anonymised industry benchmark that participating firms can compare against. The ability to see where you sit relative to peers on churn, rework, margin retention and output per hour is commercially useful intelligence, accessible only by contributing your own data.

Bodies managing large pipelines, including airports, the MOD, NHS Trusts and university estates, should make data contribution a condition of framework membership.

The ONS should break down its construction output statistics into categories that distinguish new-build infrastructure, new-build buildings and repair, maintenance and improvement. Fire-tested details, currently held as commercial IP and reinvented scheme by scheme, should be shared as an open industry resource.

2 Decide productivity at design stage, not on site

For: client boards, public-sector procurement bodies, private-sector investors

Most of the decisions that determine a project's productivity are taken before anyone arrives on site. MMC and digital coordination both have to be committed by RIBA Stage 2, while the procurement strategy, the level of off-site content and the supply chain approach are still open. After that, the options narrow quickly.

Clients should treat the end of RIBA Stage 2 as a productivity commitment point, with a defined PMV target, a procurement route and a supply chain integration approach all in place by that gate. Operating briefs, describing what a building actually needs to do, should sit alongside project briefs from stage 0.

A large share of on-site rework originates in design that was never completed before construction began. When critical design decisions are still being taken at Stage 4 or 5, the opportunity for prefabrication has already passed. Committing to clash-free coordinated models, standardised details and resolved interfaces before work starts on site is one of the most direct ways to reduce the twenty pence in every pound that the industry loses to error.[xxxvii]

For major public programmes, the design-stage commitments in the Construction Playbook should be mandatory requirements rather than guidance.[xxxviii] The planning and approvals system should support this: where regulatory gateways add time without adding demonstrable value to safety or quality outcomes, they should be streamlined. Programme certainty is itself a productivity input.

3 Reform procurement and make productivity a governance priority

For: client boards, public-sector procurement bodies, private-sector investors

The contracting findings in this report are clear on large schemes: early-involvement arrangements retain around 1.5 percentage points more of bid value than single-stage design-and-build. On a £200 million scheme, that is the difference between delivering close to forecast and losing several million pounds.

Adversarial procurement drives rework, suppresses investment in innovation, and incentivises contractors to price low and claim for variations rather than resolve problems collaboratively. Rework is one of the main ways these projects end up losing margin.

Carbon reduction across the built environment worked because it became a board-level governance priority, leading it to be tracked, reported and embedded in procurement and investment decisions. Productivity should be treated in the same way. Where procurement decisions are left to project-level discretion, the default is almost always single-stage tendering, late contractor involvement and traditional methods.

Single-stage tendering for complex projects should be the exception. Two-stage procurement, pre-construction services agreements and longer-term framework arrangements should be the standard route to market for major schemes. The Construction Playbook already sets these expectations; on major public programmes its provisions should be mandatory, and private-sector clients commissioning at comparable scale should adopt an equivalent framework.

NISTA should be given the authority to enforce compliance with Construction Playbook provisions on publicly funded programmes, ensuring that the shift from guidance to mandate has practical consequence.

We welcome the proposed ‘PAS 4010:2026 – improving productivity in infrastructure development and delivery’ standard and we encourage everyone in the infrastructure value chain to adopt this once it is published.

4 Use the public pipeline to industrialise

For: NISTA, government departments, delivery partners, UKRI

Off-site manufacturing rewards repetition and requires a pipeline of similar work. MMC clusters on larger, longer, repeatable schemes because those are the only conditions under which it pays for itself. The committed pipeline now provides exactly that profile in several sectors.

The hospital programme, the schools rebuilding programme, the prisons programme and the Social Housing Fund are all programmes of repeatable, scalable, government-commissioned buildings. Each should adopt standardised design palettes that allow component-level prefabrication and consistent interfaces across the programme.

Coordinating across government programmes would go further than any single programme can on its own. A steady pipeline of hospitals, schools, prisons and housing, visible to the market over several years, gives manufacturers and supply chains a reason to invest in dedicated production capacity. NISTA is the obvious body to coordinate this. Most building types do not suit volumetric modular construction, but standardised components, interfaces and design rules can be applied across a long pipeline and the evidence suggests the returns are significant.

UK Research and Innovation (UKRI) should establish a dedicated funding programme for robotics and AI applications in construction, focused on the tasks where automation is most immediately viable: layout marking, rebar tying, heavy logistics handling, inspection, and factory-based manufacture. The UK is a slow adopter of construction robotics relative to Singapore, Japan and South Korea, and sustained public investment in applied research and development is part of how those countries moved ahead.

HM Treasury should promote industrialisation through incentives such as capital allowances, business rates and Enterprise Zones.

5 Build and keep the workforce the pipeline needs

For: contractors, clients, government (Fair Work Agency, HMRC, CITB)

The churn evidence in this report shows that on large sites the difference between a stable and an unstable workforce is worth around £2,266 of output per hour at 500 operatives, and around £20,000 per hour at 2,000. Losses that scale up to roughly £1.3 billion a year across the NISTA pipeline. Women account for around 4% of on-site operative hours in a sector facing the tightest labour market in decades, with 400,000 retirements approaching and 250,000 additional workers needed by 2027.[xxxix] These are different findings, but the same underlying problem: a sector that does not have the workforce it needs and is not doing enough to build or retain one.

Major contractors should increase direct-employment ratios on the specialist trades where continuity matters most, including MEP coordination, structural trades on complex schemes, supervisory and setting-out roles. The priority should be to identify the areas where workforce stability has the biggest effect on productivity, and make deliberate decisions to retain people in those roles. Framework programmes and long-term client relationships are the natural place to start.

Public sector clients commissioning large contracts should score tenderers on direct-employment ratios and apprenticeship commitments. On major government-funded programmes, cross-project labour pools should be the norm, giving workers stable earnings, training and a clear view of what comes next, in return for staying within the programme rather than drifting between sites.

Most productivity lost on construction sites is due to coordination failures, rework, waiting for materials and movement across site. These are problems with how the work is organised, and they respond to measures, such as better site logistics, high-quality welfare provision and structured observation of where time actually goes. These should be treated as core project costs, funded properly from the start.

The government has a direct role here. The Fair Work Agency should prioritise construction sector enforcement on employment status, and HMRC should review whether the CIS regime’s incentive structure is actively working against the level of direct employment the sector needs. The labour-only subcontracting model that has hollowed out training and continuity for thirty years will not change without policy intervention alongside commercial change.

Every percentage point the industry adds to its female on-site workforce is a percentage point of additional labour supply. The best-run projects in the portfolio already perform better on gender balance. The conditions for change exist; what is needed is for them to become the norm.

ANNEX 1: DATA METHODOLOGY

This section sets out how the data analysis underpinning this report was carried out, the specifications used, and the limitations of the underlying data.

The dataset

The analysis draws on project-level data from 234 projects delivered by Mace Construct between 2019 and 2025. The dataset is not a representative sample of UK construction. It reflects one contractor's portfolio, drawn from operational records, and the analysis is best understood as a within-sample exercise rather than a basis for statements about the sector as a whole.

For each project, the dataset includes commercial information (bid value, gross contribution, margin erosion against forecast), workforce information (headcount, hours, gender composition), and a set of categorical flags for sector, building type, contract type, MMC content and digital maturity. A subset of projects has additional information on workforce churn at the monthly level, on client carbon reporting, and on safety outcomes from a separate operational system. Coverage varies across these subsets: of the 234 projects, GVA per hour is available for 232, gross contribution per worker for 158, margin erosion for 114, client carbon for 65, and matched safety data for around 160. The analysis notes the relevant sample size where it bears on the strength of any individual finding.

Productivity measures

Three measures of project performance are used throughout the analysis. They capture different aspects of productivity and, as the exploratory section establishes, are essentially uncorrelated with one another. They are reported in parallel where the data supports it.

GVA per hour is the rate at which on-site labour is converted into measurable output. It follows the same logic as the Construction Productivity Taskforce's framework – value of work completed divided by hours worked – but is calculated on a cost basis during project delivery from Mace Construct's operational records, rather than ex post from final revenue figures. It is not directly comparable to ONS national figures.

Gross contribution per worker measures how much of the labour deployed on a project ultimately contributes to commercial value, including both direct site work and management overhead.

Margin erosion is expressed as a percentage of bid value and captures how reliably forecast commercial value is retained over the life of the project.

Approach to the analysis

The analysis works in two stages. First, descriptive and exploratory cuts of the data are used to establish what the portfolio looks like, where particular practices and outcomes are concentrated, and whether the patterns line up with what the interview evidence describes. Second, regression models are used to test whether the relationships of interest survive controls for the project environment.

Three core specifications are used.

- Model 1 is a raw bivariate model relating the variable of interest to the productivity measure.
- Model 2 adds a control for project size, measured as the log of average monthly headcount.
- Model 3 adds controls for building type, captured as a set of categorical fixed effects, and for whether the project was active in the Live period.
- Model 4, replaces building type with sector. Where the report cites a finding as surviving controls, it survives the M2 or M3 specification. Where it does not, the report says so or relies on descriptive evidence.

For most variables of interest the M2 and M3 models are sufficient. For workforce churn, an interaction between the churn measure and project size is included in addition to the main effect, because the size of the productivity penalty turns out to depend strongly on project scale.

For contracting, the analysis is run within size buckets (small, mid and large project terciles) because the headline finding is itself a size-dependent one. For carbon, the analysis was repeated using carbon intensity (tonnes CO2 per square metre of gross internal floor area) rather than absolute carbon, to avoid picking up project scale through the back door.

Treatment of the data

A number of pragmatic decisions were taken to make the analysis tractable. Productivity measures with extreme right-skewed distributions, including GVA per hour and gross contribution per worker, were log-transformed for use in regressions. Margin erosion, which can be positive or negative and is bounded in practice, was used in level form as a percentage of bid value.

Where projects had missing data on a key control, they were dropped from the relevant specification rather than imputed.

Categorical variables with sparse cells, including some contract types and building types, were grouped where the underlying distinction was not material to the analysis.

For the contracting analysis, the original Contract Type field was collapsed into three buckets — early-involvement and collaborative arrangements (combining the Collaborative and Pre-construction / ECI categories), single-stage and fixed-price work (combining Design and Build and Traditional), and Construction Management.

The 52 projects with no recorded contract type and a small number of bespoke or consultancy entries were excluded from contracting comparisons. Airport projects, dominated by the Heathrow framework, are essentially all on collaborative contracts and were excluded from the cross-contract comparisons to avoid the framework effect dominating the result.

For workforce gender, two distinct measures are used and reported separately. The on-site operative figure is constructed from Mace Construct's operational records of male and female hours worked on-site, which capture the wider on-site workforce including subcontracted labour. The project team figure is constructed from a separate person-month dataset of Mace Construct's own employees on each project, and is matched to the main dataset by project number.

For workforce churn, the monthly panel of operative numbers was used to calculate an absolute churn measure for each month, defined as the absolute change in operative numbers between consecutive months as a share of the total. This was aggregated to project level and merged into the main dataset. The monthly time-series analysis presented in the churn section uses the same underlying panel directly, with lagged terms to account for the delay between workforce disruption and observable productivity effects.

Limitations

Several limitations of the data should be borne in mind by the reader.

The dataset is one contractor's portfolio. Findings may not generalise to other parts of the industry, and the analysis is most robust as a basis for within-sample comparison and pattern identification rather than as a statistical statement about UK construction as a whole.

The intervention variables of interest (modern methods, digital maturity, contract type, gender composition) are not randomly distributed across the portfolio. They are concentrated in particular types of project, for sensible operational reasons. The regression specifications attempt to control for the main sources of confounding, principally project size and building type, but the relationships identified should be read as associations rather than as causal effects. Where the report makes a stronger statement, it is supported by interview evidence and by triangulation across multiple specifications.

Some categorical flags in the dataset, particularly digital maturity and the modern methods indicator, are sparse, with relatively few projects flagged as positive. Findings on these variables are based on small treated samples and should be read with appropriate caution. The report leans on these findings where they line up with the interview evidence and the descriptive patterns, and is more cautious where they do not.

Coverage of carbon data, in particular, is patchy. Only around a quarter of projects in the dataset have client carbon figures attached, and the coverage is uneven across sectors. The carbon analysis is descriptive rather than inferential as a result.

Finally, the analysis is based on operational records rather than on a controlled study. Real construction projects vary on many dimensions that are not captured in any dataset, and the residual variation in productivity measures across otherwise similar projects remains substantial. The findings in this report are best read as patterns supported by the available evidence and corroborated by interviews, rather than as precise estimates of intervention effects.

Disclaimer

ANNEX 2: GLOSSARY OF COMMONLY USED TERMS

Modern methods of construction (MMC) or industrialised construction

An umbrella term for ways of building that move work away from the open construction site and into controlled factory or workshop conditions, or that use new processes and technology on-site to reduce labour and improve quality.

Pre-manufacturing

Any work carried out away from the final point of assembly before the finished components are installed, for example, in a remote factory, a near-site facility, or a temporary on-site factory.

Pre-Manufactured Value (PMV)

A measure of how much of a project's total value is delivered through pre-manufactured content rather than traditional on-site labour, supervision, plant and temporary works. Higher PMV generally means more factory-based delivery and less site activity.

Volumetric construction

The building method in which three-dimensional modules are manufactured off-site and assembled on-site to form the finished building (the core idea behind Category 1).

Panelised construction

A building method based on flat (2D) panels for walls, floors and roofs, manufactured off-site and assembled on-site (Category 2).

Pod

A pre-manufactured mini-volumetric unit, typically a bathroom or kitchen, delivered to site fully fitted out. May be structural (Category 1) or non-structural (Category 5).

Lean construction

A delivery approach that applies lean manufacturing principles – waste reduction, flow, just-in-time delivery – to construction, typically supported by digital workflow tools and building information modelling (BIM).

Gross value added (GVA) per worker hour

This is the rate at which labour time is converted into measurable output. In this instance, the value of work completed divided by hours worked on-site.

ANNEX 3: OUR COMMITMENT METHODOLOGY

This section sets out how our productivity performance benchmarks were established, the rationale behind the new Mace Construct productivity commitment and targets; and how we then extrapolated this across the NISTA pipeline to demonstrate the benefits of potential productivity improvements across the UK.

We analysed the Mace Construct portfolio (all 220 projects for which we have GVA per hour data, with outliers removed) and examined where different target levels sit within the distribution. The current 'hours-weighted' average is £67 per hour.

We then calculated what percentage improvement it would take to move the whole portfolio to the higher performance levels achieved on our best-in-class projects; and then modelled the impact if the wider industry achieved the same percentage improvement, using the ONS construction GVA per hour (£37.38 in 2025) as the industry baseline.

We established that the average of the top half of our projects was £100/hr, and if we set this as our new benchmark for 2030, this would represent a 51% productivity improvement. If the entire industry achieved the same level of improvement this would lead to an average GVA per hour of £56.44 in the ONS statistics by 2030.

We believe this is a pragmatic approach that reflects the varied context in which construction is delivered across the UK – not every project can achieve a specific GVA per hour target; but our own portfolio demonstrates that a 51% improvement from current baseline performance is a conservative and achievable target.

We then applied that 51% improvement to the NISTA pipeline value and workforce projections, housing completions, construction workforce data, and RICS cost data to estimate that a 51% productivity improvement would mean the NISTA pipeline could be delivered with 113,000 fewer workers per year, or the same workforce could produce £67bn more output. The same housing budget would deliver about 22,000 extra homes per year.

Sources and assumptions:

Parameter	Value	Source
ONS construction GVA per hour (2025)	£37.38	ONS output per hour worked, UK dataset, Section F Construction, current prices, 2025
Labour share of construction costs	35-45% (40% midpoint used)	RICS Building Costs Guide 2026
Construction cost per dwelling (excl land)	£150,000-£180,000 (£165,000 midpoint used)	Analysis of BCIS data via new-builds.co.uk, 2026. National average for typical 3-bed semi-detached, including materials, labour, plant, prelims and site costs, excluding land, s106, finance and developer profit
Housing completions	142,000/year (2024-25)	MHCLG Housing Supply: Net Additional Dwellings
Housing target	370,000/year (1.5m over parliament)	Government manifesto commitment
NISTA pipeline	£725bn over 10 years	NISTA Infrastructure Pipeline 2026
NISTA workforce demand	337,000 workers/year	NISTA/CITB projections
UK construction workforce	2.1 million	ONS
Assumed hours per worker per year	1,700	Estimated from average weekly hours in construction (~37hrs) × 46 working weeks
Mace portfolio baseline	£67/hr (hours-weighted, outliers removed)	Mace Construct GVA data
Mace portfolio 'best performers'	£100/hr (hours-weighted, outliers removed)	Mace Construct GVA data (top 50% of projects, mean average)

ANNEX 4: REFERENCES

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