

International Construction Costs 2024

Race for capacity



Foreword

Our International Construction Costs (ICC) 2024 report, titled *Race for capacity*, is published at a pivotal moment in the recovery of the global construction sector. With the post-pandemic bounce-back still affecting markets, there are additional opportunities and challenges arising from the acceleration of industrial reshoring and friendshoring.



Erik Blokhuis

Global Sales and Business Development Officer, Places

In our market commentary, we emphasize that despite the socio-economic and political upheaval in 2023, the construction markets experienced relative calm as demand eased and supply chains returned to equilibrium. 2024 is likely to mark the bottom of the market in many parts of the world.

A notable trend in 2023 was the rapid acceleration of investment in technology assets, driven by AI's demand for high-end processors and the rapid expansion of data centers. The pace and scale of programs being delivered in Northern Europe, the Nordics, the UK and the US has the potential to disrupt local construction markets as demand for labor, materials and power crowds out other development work. A race for capacity has begun. Explosive growth in these markets means that even established players have to reassess their location planning, delivery strategies and supply chains.

In our market insight section, Winner takes all, we share insights on the challenges clients face in delivering projects amid massive investment in the technology sector. Meeting planned Day 1 completion dates is a top priority for clients, but the scale, speed and complexity of these programs increase their risk exposure. Existing supply chains and delivery models require review to adequately protect multibillion investments.

Over the past two years, housing development and essential infrastructure have been battered by high inflation and costly borrowing. Weak construction markets have affected the housing and — perhaps most acutely — low-carbon sectors, causing delays and cancellations of mega-investments in offshore wind parks and battery plants. Even essential net-zero investments face affordability challenges despite the urgent need for energy transition.

This highlights the importance of construction productivity as an enabler of investment and the potential barrier of local cost premiums.

Maintaining high productivity levels in conventional building is crucial as economic growth remains low, and finance costs increase. Productivity will be key to viability. Data confirms that low-carbon performance specifications contribute to cost growth in excess of background inflation. While these buildings will perform better over their life cycle and have much less impact on the planet, to build them, they must stack up financially. Initial construction cost remains a crucial hurdle, even as investment horizons extend further into the future.

As global construction markets recover in 2024, the Arcadis view is that there is no turning back, and that future construction inflation trends will continue to rise due to market pressure and the pursuit of better buildings. While some clients may seize timing opportunities to advance projects before recovery, the industry's collective focus should be on designing and delivering projects for resource-constrained markets. The race for capacity will continue to place a premium on productivity-led design, procurement and construction to address ongoing affordability challenges.





Market overview

Less news is better news: a look back at 2023

2023 was a difficult year across the world, with high borrowing costs and weak demand for housing undercutting the positive impact of infrastructure investment in many markets. Tight monetary policy resulted in weak growth rates in most ICC cities.



Kayleigh Owen

Head of Cost and Commercial Management

The good news is that the scourge of high inflation has mostly been eliminated. Only a few markets saw double-digit inflation in 2023, while over 25 cities recorded price increases of over 5%. In contrast, the US and the UK experienced modest price hikes of 2-3%, while some markets, notably China and, for the second consecutive year, the Netherlands, saw falling prices.

China's relatively weak GDP growth of 5.2% in 2023 contributed to lower-than-expected global inflation, which helped to moderate construction price increases. Energy prices and metals markets held steady as the Chinese real estate market continued to misfire. With

China targeting stronger growth of over 5% in 2024 and beyond, recovery in the world's largest construction market is likely to coincide with a cyclical upturn in Western markets.

Although 2023 will be seen as a year for stabilization in retrospect, disruptions were always in the background. Conflicts in Ukraine and the Middle East, major climate change events, and the earthquake in Turkey and Syria contributed to a chaotic year. Fortunately, interruptions to global trade through the Panama and Suez Canals were limited due to a slump in trade volumes.

Ultimately 'less news' characterized 2023. In contrast, 2024, the year of elections with over half of the world's population going to the polls in over 60 countries, promises a much bumpier ride. For construction businesses, the immediate impact could be an interruption to business as usual, as public procurements are held up by election processes and spending priorities are challenged. Looking ahead, freshly elected governments can be expected to bring a whole new set of priorities, with implications for workload and long-term strategy.





How expensive is it to build in your city?

How to use the ICC Index

Discover our data insights into global construction costs, including our annual comparative cost study of 100 global cities, and regional cost comparison data across EMEA, APAC and the Americas; data insights into construction-specific price inflation; and an additional construction cost index on highly serviced buildings for assets such as data centers and manufacturing facilities.

The ICC index is primarily intended to compare costs for complete buildings. The data in the index can be used to estimate the expenses associated with delivering a specific building function across different geographies using existing benchmark data.

When comparing costs using the ICC index, it is important to consider other factors such as currency, specification differentials, site constraints and location-specific requirements. The ICC data is presented as a range, and values can be chosen from within that range to account for differences between the base and target buildings.

It is worth noting that certain cost aspects, such as location-specific works and utilities provider costs, should not be solely calculated using ICC data. This is because the scope of work can vary between sites, requiring estimates based on initial designs. However, ICC-derived ratios can be used to adjust the rates.

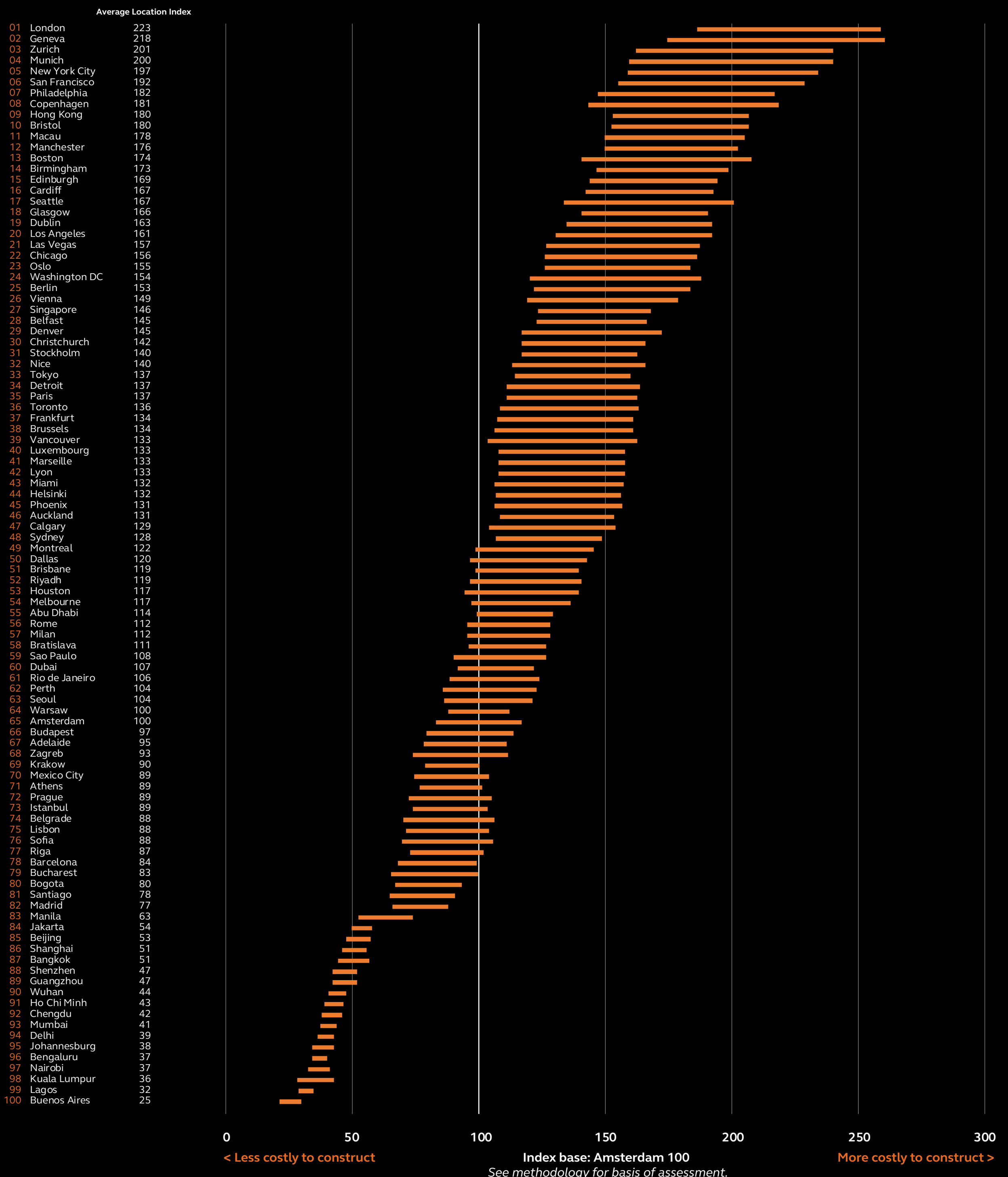
The ICC data is not suitable for cost adjustments in highly serviced buildings such as data centers. It can only be used to estimate the costs of the building shell and basic services installation. Adjustments to the factor used may be necessary if the base building is particularly complex.

In the ICC 2024 report, we introduce a highly serviced building construction cost index (HSB index).

The high technology construction cost index provides a high-level indication of cost differentials in select key locations. Guidance on how to use the index is included in the report.

International Construction Cost Index 2024

ICC data should be applied as a ratio | Target location index/Base location index = adjustment factor

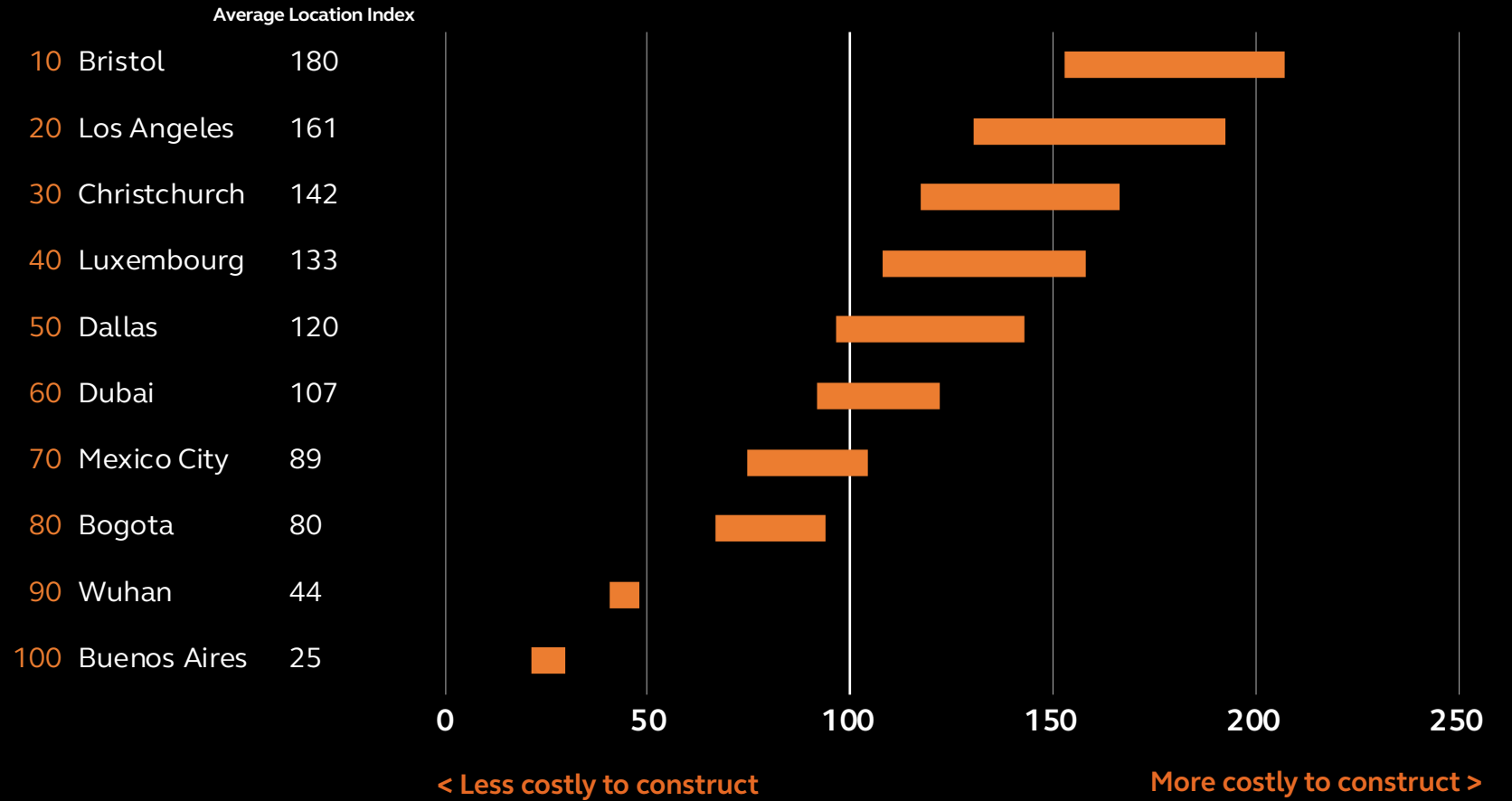


Regional International Cost Comparison 2024



International Construction Cost Comparison Decile Cities

Index base: Amsterdam 100
See methodology for basis of assessment.



This chart summarises the ICC data by presenting data for 10 international cities representing the decile points of the 100 city dataset. The analysis highlights the geographical distribution of higher and lower costing cities

Indicative construction inflation for key locations 2023 and 2024

Arcadis estimates for construction tender price inflation for the 12-months prior to the 4th quarter of the stated year. Costs are for building construction only and do not necessarily apply to either volume housebuilding or infrastructure.

The table provides data on construction-specific price inflation for both 2023 and 2024. This inflation reflects the changes in construction prices paid by clients, rather than the input costs paid by contractors and the supply chain.

In 2024, inflation is forecast to continue to fall substantially in most construction markets. The main exception is the United States, where the pace of price increases fell quickly in 2023, and where the rate of inflation is expected to pick-up a little faster in 2024. The table highlights that many countries experienced above-trend inflation in 2023, which posed challenges to the viability of many projects.

The decrease in prices observed in Beijing and Amsterdam in 2023 can be attributed to localized market issues that we anticipate will be resolved in 2024.

As construction markets continue to recover beyond 2025, it is expected that inflation will align with long-term trends, which are typically higher than consumer price inflation.

- Faster price growth
- Stable and slowing price growth
- Falling prices

ASIA-PACIFIC

Change	2023 v 2022		2024 v 2023	
	%		%	
Auckland	5 to 6	●	3.5 to 4.5	●
Beijing	-2 to -3	●	1.5 to 2.5	●
Brisbane	6.5 to 7.5	●	7 to 8	●
Dehli	5 to 6	●	6 to 8	●
Hong Kong	3 to 4	●	1.5 to 2.5	●
Jakarta	4 to 5	●	4 to 5	●
Kuala Lumpur	3 to 4	●	3 to 4	●
Singapore	2 to 3	●	0 to 3	●
Sydney	5.5 to 6.5	●	4.5 to 5.5	●
Tokyo	3 to 4	●	2 to 4	●

EMEA

Change	2023 v 2022		2024 v 2023	
	%		%	
Abu Dhabi	3 to 4	●	2 to 3	●
Amsterdam	0 to -1	●	3 to 4	●
Athens	3.5 to 4.5	●	2 to 3	●
Berlin	6 to 7	●	4 to 6	●
Dublin	4 to 5	●	3 to 4	●
London	2 to 3	●	1 to 2	●
Madrid	2.5 to 3.5	●	2.5 to 3.5	●
Paris	2.5 to 3.5	●	2.5 to 3.5	●
Prague	0 to 1	●	2 to 3	●
Rome	2 to 3	●	2 to 3	●
Vienna	4 to 5	●	3 to 4	●
Warsaw	10 to 12	●	5 to 8	●

AMERICAS

Change	2023 v 2022		2024 v 2023	
	%		%	
Boston	2 to 3	●	3 to 4	●
Chicago	0.5 to 1.5	●	1 to 2	●
Dallas	3 to 4	●	3.5 to 4.5	●
Mexico City	6 to 8	●	4 to 6	●
Miami	2.5 to 3.5	●	3 to 4	●
New York	1.5 to 2.5	●	2 to 3	●
Phoenix	2.5 to 3.5	●	3 to 4	●
Rio De Janeiro	5 to 7	●	4 to 6	●
San Francisco	2.5 to 3.5	●	3 to 4	●
Seattle	5 to 6	●	5.5 to 6.5	●
Toronto	0.5 to 1.5	●	3 to 4	●
Vancouver	2 to 3	●	3 to 4	●



Index insights

For 2024, we have retained our coverage of 100 key cities in locations across the globe and thank our partners for their contributions, acknowledged in the report.

A significant development in the ICC 2024 report is the introduction of a highly serviced building construction cost index (HSB index). This index has been specifically created for clients involved in the construction of complex buildings with advanced technology components, such as data centers, gigafactories and wafer fabs. This additional index is necessary because the costs of these specialized buildings do not vary to the same degree as our core ICC index. The HSB cost index is derived from a combination of modeled and project-derived data. For more details, please refer to the high technology construction cost index section.

London and Geneva continue to be the most expensive locations to build in, with London narrowly taking the top spot in 2024. Although levels of inflation were moderate in the UK, specification enhancements related to building safety, sustainability and client expectations pushed prices up further than most other locations. Bristol, a regional city in the UK, enters the top 10 for the first time. Munich, experiencing double-digit price growth, moves up the rankings to claim the 4th position, surpassing New York and San Francisco.

German cities continue to face high inflation due to capacity constraints, even as the housing market crashed. Philadelphia also climbs higher in the top 10, with inflation exceeding 5%, which is significantly higher than in most other US cities. Inflation in the US typically fell to 2-4% after hitting double-digit increases

in 2022. In the Netherlands, markets remain stagnant, with Amsterdam — our datum location — falling to the 65th rank.

Local inflation emerges as the primary factor driving changes in the ICC 2024 index rankings, with very little movement driven by currency fluctuation. There are two exceptions in – UK cities, where the index values were boosted by around 2% due to currency effects. In contrast, despite experiencing inflation rates above 5%, Australian cities fall down the rankings due to a weaker Australian dollar. Notably, cities like Istanbul, Lagos and Buenos Aires witness high inflation but their rankings are offset by the depreciation of their local currency against the US dollar. For instance, the Argentine peso loses three-quarters of its value against the US dollar as inflation exceeds 200%.

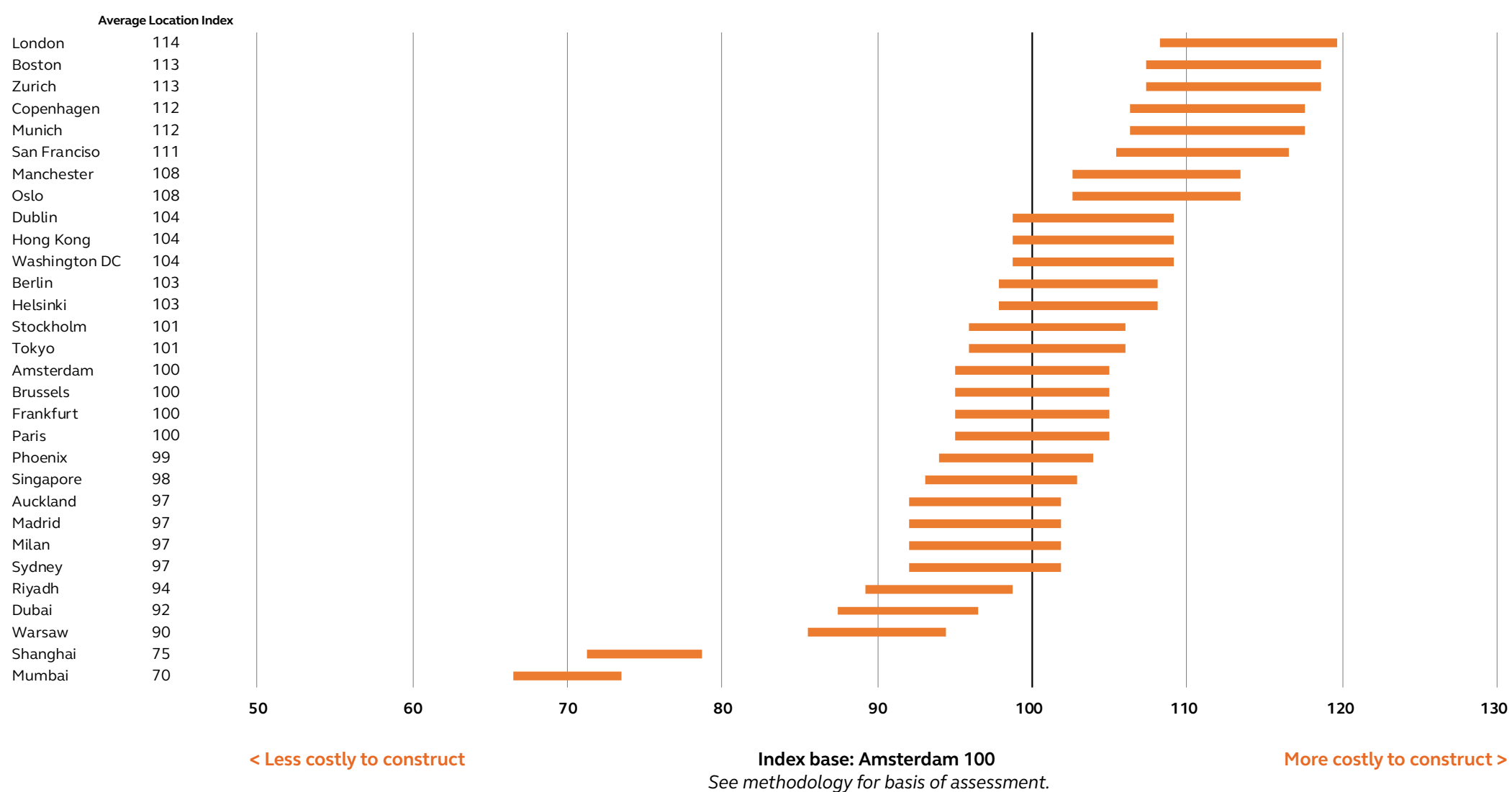


Highly serviced building construction cost index and insights

Our definition of a highly serviced building is one that features building services plant and systems within the completed building shell that exceed at least 50% of total project value. All client fit-out such as data halls, production equipment and associated utilities are excluded from the scope of the factor. The most representative building type covered by the HSB index is a data center.

Highly serviced building construction cost comparison 2024

Index: Amsterdam = 100

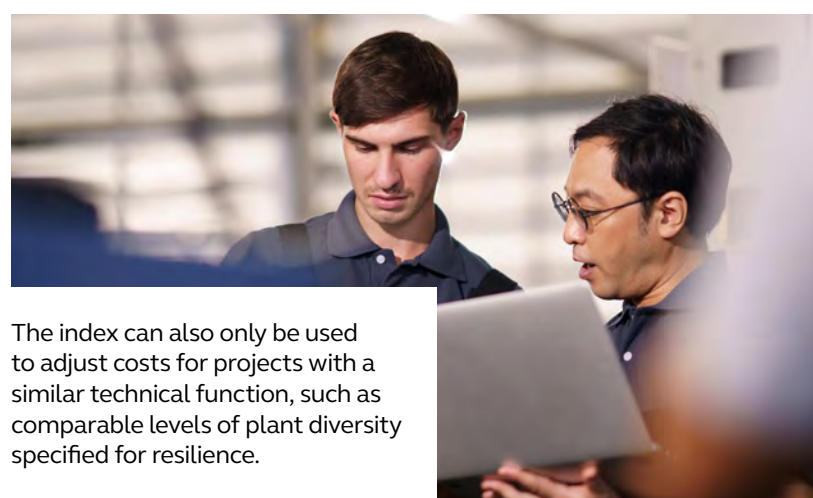


The HSB index should also not be used to adjust costs for location specific external works and utilities provider costs. Ratios derived from the main ICC could potentially be used to adjust the rates used.

The HSB index range is narrow compared to the main ICC. This partly reflects the application of global specification standards for some highly serviced buildings including data centers, meaning that there is less scope for local variation. The high proportion of the value of building services plant and equipment also results in a narrow cost range as the cost of these elements varies less between country to country than in-situ construction works.

High-cost locations from the main ICC are found at the top of the rankings including London and San Francisco. Cost levels in Amsterdam are higher relative to many European locations. This reflects Amsterdam's status as a major data center cluster as well as the effect of continuing inflation affecting high technology projects in the Netherlands, even as other sectors have seen deflation in response to a slowdown in work.

The HSB cost index should be applied with extra care. It should only be applied to buildings with a high proportion of high-value service installations and should be used to calculate building costs of the fully serviced shell only.



The index can also only be used to adjust costs for projects with a similar technical function, such as comparable levels of plant diversity specified for resilience.

Costs of installations within tenant/serviced areas and costs of external services including power supply will need to be assessed on a project-specific basis.





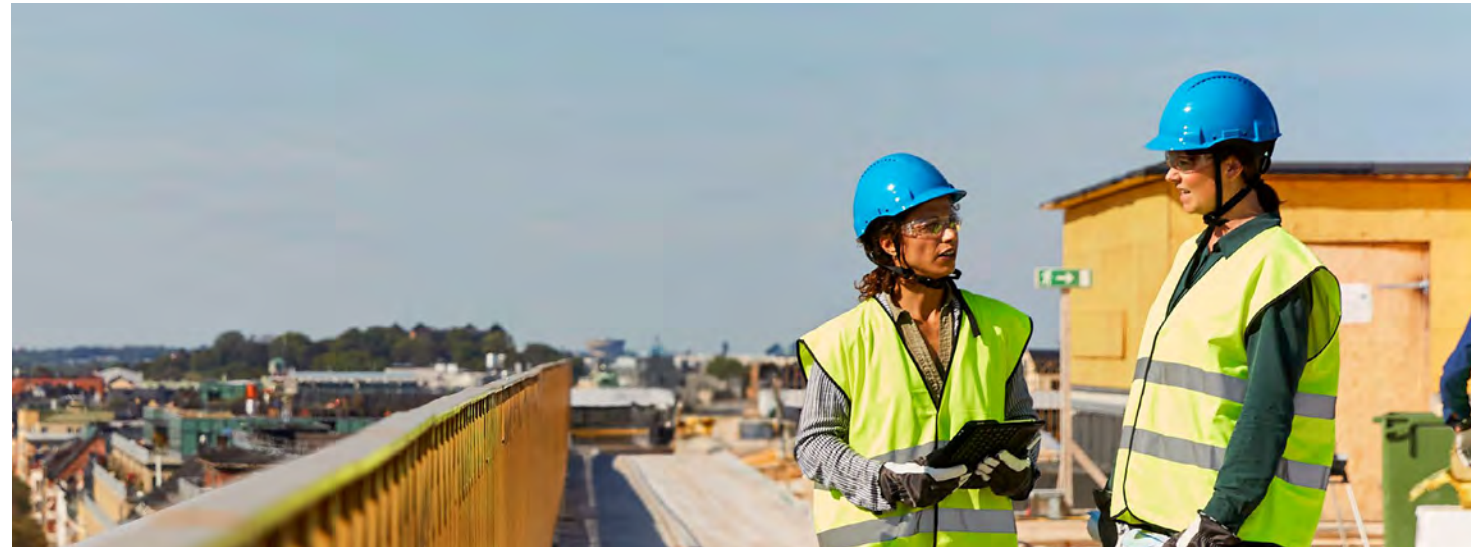
No going back – inflationary cycle forecast to return

There are increasing hopes that a ‘soft landing’ will occur in 2024, paving the way to lower borrowing costs and stronger growth. Both the International Monetary Fund (IMF) and Organization for Economic Co-operation and Development (OECD) have called 2024 as the bottom of the current cycle, albeit the pace of recovery into 2025 is expected to be weak. Despite reduced expectations, interest rate cuts of between 75 and 100 basis points are currently anticipated across Europe, US and UK for 2024. This will be positive for sectors sensitive to interest rates, including technology, commercial property and housing.

However, there will be no return to ultra-low funding costs, and viability hurdles will need to reset at a permanently higher level. Shorter overall development programs, faster construction and permanently lower land prices will

contribute to an improved return on investment. Control of construction costs will also play a critical role, but the window of opportunity for low inflation will not stay open for long.

One of the challenges that will follow a soft landing is that growth will occur against a background of historically low unemployment and ‘sticky’ core inflation. Furthermore, accelerated investment cycles associated with energy transition, network investment and real estate decarbonization can be expected to coincide with a recovery in cyclical building sectors such as housing. As a result, current benign market conditions are unlikely to continue beyond 2024. Markets that are expected to see accelerating inflation in 2024 include China, the Nordics, South East Asia and the US.



There is still a risk of policy and market failure during 2024. A delay in lifting base rates could trigger an unexpected downturn. Existing conflicts could escalate, and the outcomes of multiple elections could result in changes to the settled order. A loss of confidence would set back the construction recovery given the importance of housing and commercial development to future growth.

With industry capacity already at risk in many markets because of insolvency and constraints on available finance, clients can play a role in stabilizing the market by bringing forward new investment. However, they will need to remain alert and prepared to carry risk as the impacts of post-pandemic disruption continue to affect the industry.



Winner takes all

Meeting the demands of complex, end-date critical construction programs



Martijn Karrenbeld
Global Market Sector Director,
Industrial Manufacturing

Assuring the delivery of fast complex programs

Our sector feature in the ICC report focuses on the explosion in demand for end-date critical projects including data centers, gigafactories and wafer fabs. New clients, new technologies and new business models are all being developed 'in flight' even as multi-billion-dollar programs are built.

We look at how the fundamentals of fast complex programs create challenges for design, procurement and construction capabilities. We also examine how these programs introduce new risks and demand fresh perspectives including the need to embrace change.

Exponential growth places certainty of delivery at risk

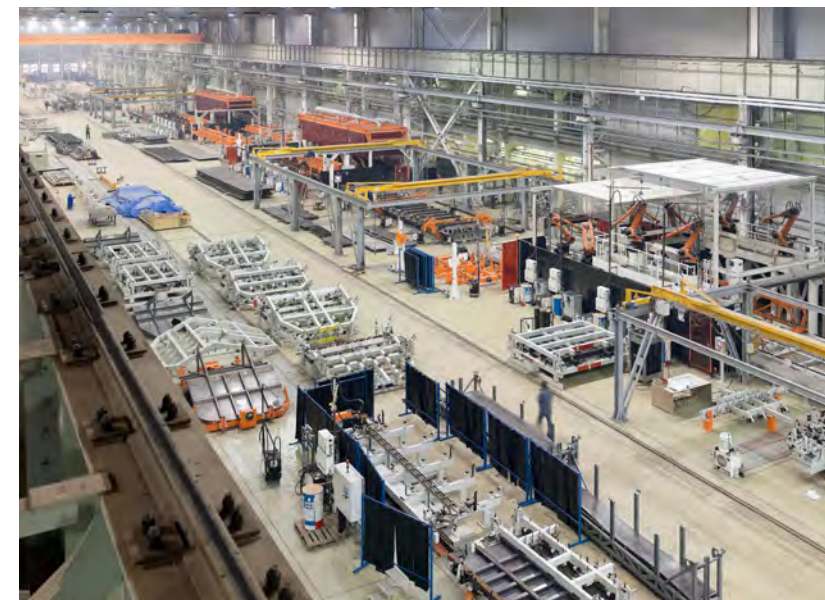
Mega-programs share many characteristics including scale, speed and extreme technical complexity. For clients, the most important by far is certainty of day 1 completion. This is driven mostly by consequential business risk, but project teams also face challenges in accommodating the latest technologies on fast-moving, complex programs.

To assure certainty of delivery, clients should focus on how programs are configured to secure both capability and capacity in line with the end date. Failing to do so could have significant

consequences for clients that have huge investments riding on right first time, on program delivery. At best, the program will be stressful and suboptimal. At worst, delivery dates will slip with consequences for return on investment and reputation.

Against this challenging background, our analysis focuses on three areas for client attention:

- Pressures on industry capacity and capability
- The compounding effects of scale on risk exposure
- The need for a rethink on enterprise models





CASE STUDY

Wafer fab

A semiconductor manufacturer is developing new production capacity in response to explosive growth in demand and political support for reshoring investments.

The manufacturer's response to growing competition for contractor resource is a strategic focus on the readiness of the supply chain – particularly regionally-based specialist contractors. This includes an early-staged appointment model providing sufficient certainty to enable contractors to invest in workforce development.

Although the investment mitigated some risks around workforce availability, problems were still experienced, including competition between package contractors for common skill groups associated with management, supervision and commissioning.

The case study illustrates issues including:

- Even with forward planning and investment, the sheer scale of mega-programs will 'create their own weather' associated with resource availability.
- Early contracting with key suppliers to build capacity will potentially influence the commercial model – particularly on the lower tiers.



Capability and capacity: stretched to the limit.

Most construction clients are accustomed to compromise; and construction, an industry with value engineering at its heart, sometimes delivers suboptimal results. By contrast, for time-critical mega-programs, there is no room for compromise. Across multiple dimensions, the capabilities of delivery teams will be stretched well beyond the norm.

The program team's scope extends across the full range of activity from initial site selection to final handover and day 1 production. It is better thought of as an enterprise, comprising the client, and its full range of internal stakeholders together with the delivery team of consultants, designers, general contractors (GCs), specialist contractors and equipment suppliers.



On high technology programs, premium costs will be incurred to secure capacity and to deliver at scale, but other pressures will also stretch the capability of the client team and the program team:

- First-of-a-kind innovation.** Many projects will involve the integration of processes and technologies that have little or no precedent. Uncertainties associated with the selection and specification of these technologies might affect permitting, as well as design and execution. Ideally the shell should be designed outwards from the process at its core.
- Start-up mindset – building the enterprise.** Some clients will face the challenge of building their organization parallel to developing the technology and delivering a capex program. Key issues around leadership, organizational design, clear and effective decision making, and stakeholder management will be resolved in-flight, even as the project is being taken forward.
- Volume of work and rate of spend.** Construction also faces scaling problems related to installation complexity, interface management and coordination, and ability to respond to change.
- Accommodation of change.** Change is endemic and must be embraced while being
 - accommodated within the disciplines of cost and program certainty. The program culture must embrace change, understanding and managing the full implications in real time.
- Program complexity.** Complexity multiplies the scale of scheduling and sequencing problems. Much of the complexity is related to interdependences across the program, such as those between utilities hook-ups and equipment design. Gateway reviews, comprehensive interface management and so on will all deal with complexity risks.
- Right first time quality.** Meeting strict specifications and deadlines requires specialized skills in quality control and commissioning
- Optimism bias.** Optimism bias is the tendency for clients to underestimate the cost and time implications of complex undertakings including the consequences of change. This is countered by a holistic view of the program, by early impact assessment and access to granular program and cost data.



CASE STUDY

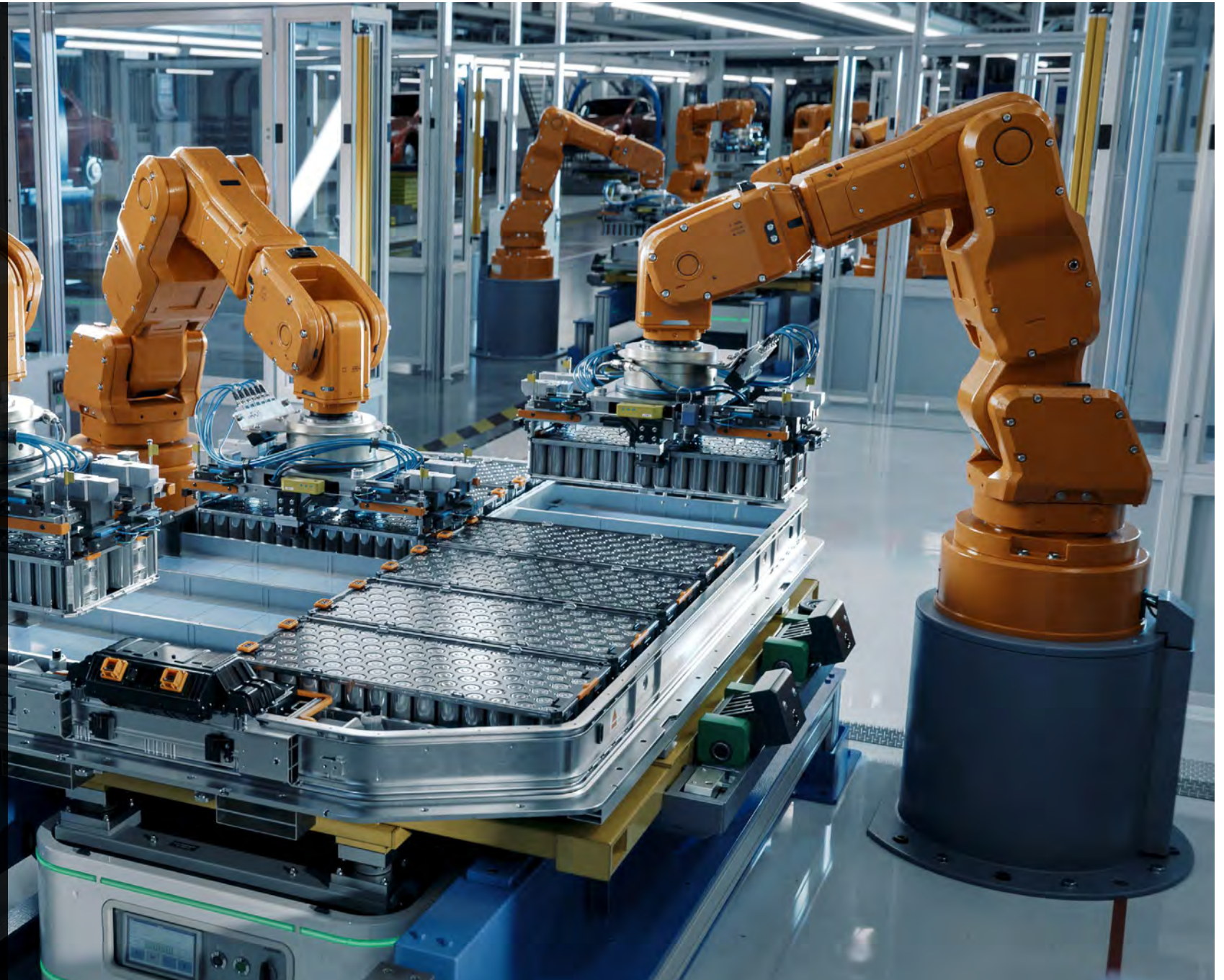
Gigafactory

The client's R&D team was finalizing the battery manufacturing process in parallel with the building and utilities design. The maturity level of the process systems requirements was not always understood, creating integration issues for the shell delivery team.

Led by a GC focused on maintaining pace toward the end date, the shell team delivered against the initial design. Ultimately, progress of the MEP utilities was problematic, largely due to process specification changes and early commissioning requirements. The project's later phases, including the phased handover of clean spaces, were better coordinated based on the full understanding of the requirements of the equipment suppliers and the program demands.

Lessons learned from these challenges include:

- The importance of appointing a delivery team that appreciates the program constraints and can balance delivery at scale and ability to change.
- The key role of the employer's requirements in communicating the full scope of design and construction requirements including equipment.
- The value of embedding the operational understanding of day 1 into the initial design, controls and commissioning strategies.
- Securing internal support from the R&D team to expedite process-related decision making.





Compounding scale and risk: an increasingly challenging program environment

As highlighted, complex programs are being delivered in an increasingly challenging marketplace. Inevitably, as more large-scale, end-date critical programs are brought to market, delivery risks will grow.

Many of the major risks affecting these programs are well understood, such as the interface management between shell systems, long lead-in equipment and tenant spaces. Managing trade-offs when resolving risks like these will become more and more important. The ability to model program dependencies, model risk scenarios and plan for low-pain change will be increasingly valuable.



Risks can be magnified by cultural differences within global, virtual teams and by suboptimal stakeholder and change management. A greater focus on program-wide culture and communication will enable detailed construction and assembly-related information to be shared with all stakeholders, including equipment suppliers.

Greater transparency and teamwork, better coordination using Responsible, Accountable, Consulted, Informed (RACI) and enhanced interface management enabled through digital platforms will help mitigate risks that have grown due to a combination of market pressure and technical complexity.



CASE STUDY

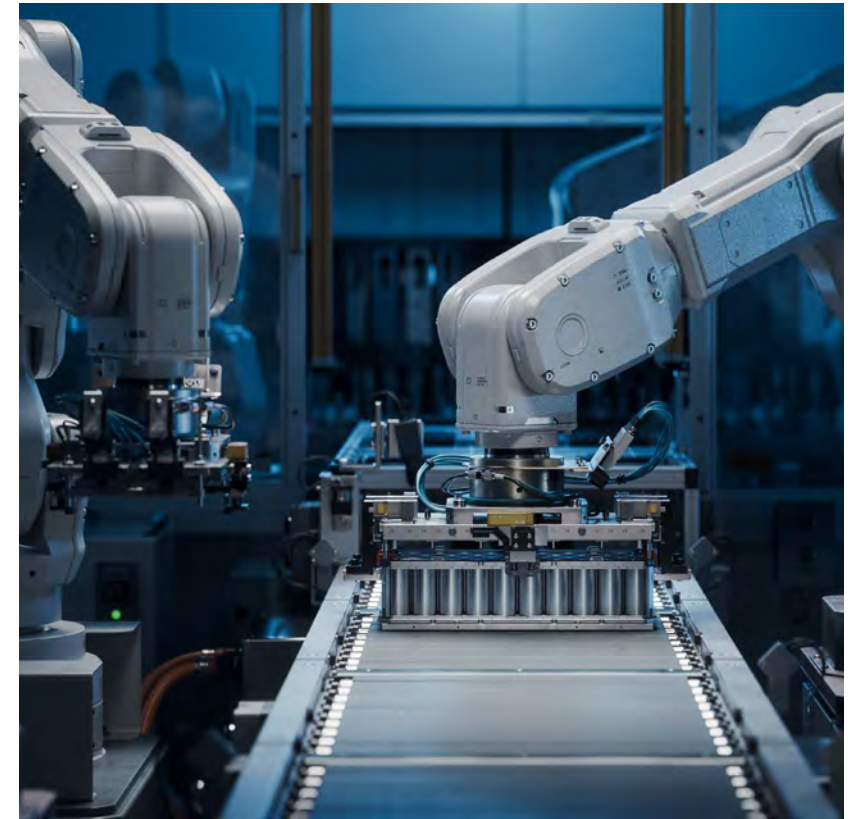
High technology process plant

Change, risk management and organizational transparency

This case study considers the risks emerging with a process plant being developed by a start-up organization. The program involved new technology that was still under development. Necessary changes delayed permitting and as a result, the program's process had to be accelerated. This included early procurement of enabling works.

The resulting contractual arrangements eliminated commercial pressure and further delayed the development of detailed design proposals to meet the technical specification. When change did occur, much of the cost was incurred by the client rather than held by the supply chain.

Although client-side risk exposure increased, no additional steps were taken to invest in assurance activity. This reflected a high level of optimism bias within the client team. As the impact of open risks crystalized, further cultural issues became apparent that increased pressure on the delivery team.



Lessons learned from these challenges include:

- The importance of the early establishment of project culture, communication and commercial strategy to embrace the 'known unknown' of anticipated change requirements.
- The scale of cost premiums that can result from steps required to maintain progress toward the end date and the benefits of early sequence optimization.
- The value that external parties can bring in terms of broader risk perspectives and enhanced assurance.



Is a new enterprise model needed for fast complex programs?

As more capital is directed toward AI, life sciences and advanced manufacture, competition for construction partners that can deliver the desired combination of capability and financial firepower will grow in intensity. But demand for resources will come from other sectors too, including large-scale investment in power and water networks as part of climate change strategy. In reality, too many mega-programs are running in parallel, placing unprecedented pressure on an industry that is configured to deliver multi-million rather than multi-billion-dollar contracts.

For the bigger firms, there will be no shortage of workload and plenty of opportunity to diversify geographically and by sector. For clients delivering end date-critical programs, this could present a problem across many markets. Contractors will want the projects as an opportunity but won't necessarily be willing to shoulder all the risk.



There are a number of implications for mega-program clients, including:

- **Growing competition** for contractors resulting in a 'seller's market'
 - **Scale constraints** related to the capacity of specialist contractors such as clean rooms
 - **Too many programs pursuing too few major contractors** where alternatives may be needed
 - **Levels of risk transfer will exceed the capacity of GC balance sheets** where different risk transfer models are needed
- A pre-emptive review of commercial arrangements is a good way to start to mitigate this risk, covering issues including:
- **Resourcing the team** – focusing on end-date delivery
 - **Contract model** – single contract vs. package model
 - **Assurance vs. certainty** – does risk transfer represent the best value compared to risk management?

Clearly current delivery models are under pressure. As the programs' pace accelerates, there is an increasing risk that critical points of failure will emerge, either with respect to attracting capacity or agreeing to an acceptable contract.

Clients gain much certainty from working with familiar contracts and settled project teams. In any market there are a finite number of 'A teams' and as competition for resources grows, clients will need to adapt to the dynamics of a seller's market.



CASE STUDY

Data center

Adapting to supply constraint and new market opportunities

A data center developer has a large-scale, serial program of data center development. However, rapid expansion plans have triggered a review of the procurement model.

The established model relies on a general contractor delivering a lump sum contract, directly employing the specialist contractor supply chain. The client directly procures long lead-in equipment. The risk premium cost paid by the client post-Covid has increased significantly, the balance between cost and value delivered by the GC model deteriorated and the client is reviewing available options.

Package-based models like those used under the construction management procurement model are being considered. Benefits include the elimination of layers of cost and ability to access local supply chains in new markets. Challenges include the design of the package management layer including requirements for new capabilities within the client organization.



Lessons learned from these challenges include:

- The importance of the client's in-house capability that enables package-based approaches to be adopted.
- The continuing need to ensure that all capabilities are resourced across the team and that new integration issues are addressed.
- The client's recognition that, although the proposed model should deliver better value, it involves further risk and resource transfer to the client to secure these outcomes.



Race for capacity

As the number of mega-projects being brought forward increases, challenges for clients will also grow.

Resources will become harder to secure and commercial deals that worked in the past might no longer be accepted in a capacity constrained market. Programs may also become more complex and the need to effectively manage global, multicultural teams will become more acute, for start-ups and for industry champions alike.



Such circumstances are a great prompt for clients to consider if their enterprise model for end-date critical delivery remains optimum. Can it be improved? Does it work in all locations? Are there new sources of risk that are not directly addressed?

Many clients have well-established ways of working on projects that are aligned to their wider business environment. Change is difficult to introduce, particularly when programs are running so hot.

But incremental improvement is possible and beneficial. By considering the key issues set out in this paper and by applying the Arcadis five-point review framework (overleaf) as an assessment tool, we believe that clients can give themselves and their teams greater confidence that they can deliver to plan – and win.



Assuring the delivery of fast, complex programs – five-point review framework



Edel Christie

Chief Growth Officer

For a group of clients who are focused above all on meeting a contracted end date, the prognosis is that current delivery models might need change – to improve internal stakeholder management, to attract more capacity, to better engage with the capabilities of a global supply chain or simply to ensure that risks are covered when problems arise through better use of data, insight and decision-making. We have brought together our experience derived from multiple high technology programs to develop a series of key prompts.

The framework is market, technology, and contract agnostic, but takes its cues from the experience of our teams and our insights into how markets around the world are evolving and how clients are responding to these changes. These prompts will help clients consider a range of opportunities to on complex programs, even as the market for delivery evolves at a rapid pace.



Clarity of purpose

Is the project organization fit for purpose

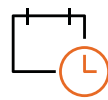
- Scale-up in response to the level of innovation and size of the task
- Build-in resilience to deal with setbacks
- Assure the maturity and resilience of the client organization including leadership



Client's role

What task must the client undertake to ensure success?

- Focus on leadership, team culture, stakeholders and money
- Own the scale challenge and equip the team to manage it
- Engage fully in the management of risk - including ownership where need



Protecting the end date

Is the Day 1 objective driving the program?

- Outcome thinking - define what Day 1 is and identify the critical milestones and the end-date sequence
- Model program interdependencies to prepare for disruption
- Respond to the implications of missed dates across the program



Enabling effective change

Can the team anticipate and facilitate low-pain change?

- Develop a ready-for-change culture - keep it clear and simple
- Prioritise assurance over certainty - secure an economic balance of risk transfer
- Understand and transparently report the consequences of change



Assured decision making

Is the right data available to support assured delivery

- Use live data and integrated models to break down silos
- Invest in data and controls to increase levels of confidence
- Avoid paralysis by analysis - trust the direction of travel as well as the detail

How this framework will help

In the ICC 2024 report, we have highlighted that the technology and advanced manufacture sector is one of the few global markets that has seen rapid growth in the past 1-2 years. Even as market conditions stabilize in other sectors, the specific dynamics of the mega-program segment will combine to create further challenges for clients in a fight to be first – in securing consents, in contracting supply chain capacity and in delivering to market.

Construction around the world

NORTH AMERICA

USA

Federal and state interventions appear to have had highly positive impacts on some sectors of the country's construction market which offset a slump in others.

The US economy expanded 2.5% in 2023, up from the 1.9% recorded in 2022. The OECD is currently forecasting annual GDP growth of 2.1% for 2024. Interest rates are currently at a 23-year high of 5.25-5.5% but are likely to fall by several increments in 2024, as inflation falls towards the Fed's 2% target by mid-year.

Recent data from the Associated General Contractors of America (AGC) showed total annual construction spending in the US reached \$2.1 trillion in January 2024, in current prices, almost 12% higher than a year earlier. The construction market is strong in certain sectors, ranging from industrial and infrastructure to technology and life sciences. The CHIPS and Science Act, for example, has contributed to a doubling of construction spend on factories in 2023 compared to 2022, totalling nearly \$200 billion. The computer and electronics segment has been the key sector driving this manufacturing construction boom, accounting for 64% of that spend.



Investment in infrastructure is being driven by federal and state initiatives. For example, the \$45bn Rebuild Illinois bill will provide the state Department of Transportation with over \$20bn to fix roads, viaducts and bridges. In California, the 2028 Olympics in Los Angeles is acting as a catalyst for infrastructure development in the region including transport networks.

However, the commercial, hospitality and retail sectors have slumped, with commercial being the slowest to show signs of recovery. In Chicago, for example, office values have fallen dramatically. An uptick is not expected due to high interest rates and high levels of post-pandemic home working.

With a different approach to regulation, the United States remains behind Europe with regard to low carbon building. Aspirations are often reduced as part of value engineering and projects are therefore often delivered with a less ambitious set of sustainability measures.



“While inflation continues to moderate in 2024, uncertainty caused by the US Presidential election and global events in Ukraine and Israel will continue to influence the market in the year ahead.”

David Hudd
National Discipline Leader,
Cost & Commercial
Management

Mega projects continue to be disruptive to the 'local' contracting community in terms of their impact on availability of local skilled labor, affecting for example the cost and availability of electrical trades in the vicinity of data center projects. Maintaining workforce engagement and continuity has been a particular challenge in 2023 as the extent of large-scale industrial investment has ramped up.



“Overall, the construction market in Canada is one of opportunity with some sectors requiring a bit more caution and patience, notably residential. Looking ahead, the availability and capacity of skilled labor to participate in construction projects will be a growing constraint.”

Audrey Jacob
Business Area Director, Places

CANADA

High interest rates coupled with inflation dampened Canada’s construction market through 2023 but there are a few bright spots on the horizon in 2024.

While GDP rose by 1.1% in 2023 – the third consecutive year of growth – it was the slowest pace since 2016 and aligns with more traditional growth levels after a few years of significant rises. Slow growth is forecast for 2024 as interest rates at near cyclical highs curb investor sentiment, suggesting caution and tempered expectations.

In construction markets, high rise residential is particularly challenged; downward movement in both the cost of borrowing and construction costs, which is anticipated later in 2024, is required to turn the tide materially. The housing shortfall is acute across most of the country. Federal immigration policies are fuelling population growth and associated consumer demand. The federal government unveiled a new C\$6 bn Canada Housing Infrastructure Fund, in recognition of the critical infrastructure required to address the country’s housing shortage. Continued population growth is also driving demand for healthcare and education related projects.

Investment in infrastructure is expanding, while workloads for industrial and manufacturing are resilient. Summer 2024 should

see a contractor appointed to Canada’s largest infrastructure project – the addition of 1,000km of new rail track to provide high speed rail services between Quebec City, Montreal, Ottawa, and Toronto. Transit investment projects continue to emerge across the country.

Continued on-shoring and just-in-time delivery is driving industrial facility demand. The industrial segment will be boosted by plans from US chemical firm Dow to build a US\$6.5bn net zero petrochemical plant in Alberta, with construction starting this year. Building on the C\$7 billion VW project which commenced in 2023, various other auto manufacturers are considering expansions; reports suggest that Honda may build a US\$13.8bn electric vehicle plant in Ontario.



EUROPE

NETHERLANDS

The Dutch construction sector has faced a slump in workload due to pollution regulation. A slowing economy will place a lid on the pace of recovery in 2024.

A slow-down in global trade led to meagre annual GDP growth of 0.1% in the Netherlands in 2023, down from 4.3% in 2022 during the Covid-19 recovery. Latest forecasts suggest growth is likely to remain flat at 0.3% in 2024, rising to 1% in 2025.

Total construction production grew by just 1.5% in 2023, with the highest growth in the civil engineering sector, where a sharp increase in investments relating to the energy transition boosted activity. This was offset by a 7% contraction in new housing construction.

New construction across all sectors is likely to be under pressure in 2024, with new residential and non-residential activity forecast to decline by 10%.

In housing, supply-side issues such as a shortage of land and in particular legal delays relating to nutrient neutrality will continue to limit delivery during 2024. The number of new home permits declined to 56,000 in 2023, from a peak of 75,800 in 2021.

In Amsterdam, budget constraints delayed investments in the metro as well as a new bridge over the IJ – the city's waterfront. Meanwhile in Rotterdam, 2023 saw the viability of new high-rise residential towers impacted by increasing costs and affordability levels. Looking forward, Rotterdam has a major programme to replace or maintain bridges, tunnels and docklands, plus new stations and station upgrades along the 'de Oude Lijn'.

Urban regeneration projects around these stations are also planned. Fundamental measures associated with net zero targets have been standard in the Netherlands for several years, so their impact on price levels is presently minimal.



“Events of the past couple of years have shown how insight into the risks, costs and cost developments of construction projects are essential to keep them affordable and feasible.”

Ted Peek
Senior Consultant, Cost & Data Management

GERMANY

Times have been tough in the German construction market, particularly in financially sensitive sectors like commercial and housing, but opportunities in industrial and infrastructure still exist.

The German economy contracted by 0.3% in 2023 as high inflation, rising interest rates and weakening international trade all took their toll. The OECD is currently forecasting annual GDP growth of 0.3% for 2024 and 1.1% in 2025. Construction is a key part of the German economy, accounting for about 6% of GDP and employing 2.6 million people. However, 2023 saw the sector enter a deep recession, with builders facing a perfect storm of rising interest rates, increasingly expensive materials and a very tight labour market.

The situation was most strongly felt in the residential sector, with housing completions expected to fall from 295,000 in 2022 to 242,000 in 2023, according to housing association trade body GdW. The numbers are likely to be lower still in 2024, given that the volume of residential building permits declined by 27% to 260,100 in the last 12 months – the lowest level since 2012. In an effort to boost the housing construction market and the stock of affordable homes, the German government last year suspended the tightening of new building efficiency rules initially planned for 2025.

Elsewhere, reports show a rising level of insolvencies in the commercial real estate sector, with failures like major developer Signa at the end of 2023 suggesting that the bottom in this segment has not yet been reached. Clients are refurbishing offices, rather than building new. Contractors are expecting conditions to remain extremely challenging over the coming 12 months, with both PMI and Ifo surveys showing about half of firms anticipating a decrease in activity in 2024.

Infrastructure and industrial represent the best hope for growth in 2024. Giga factories, semi-conductor plants and large data centres continue to be developed and built, with projects including a major battery plant for ACC in Kaiserslautern, the FRA7 data centre in Frankfurt and a wafer-fab plant in Magdeburg. Meanwhile power transmission projects from North to South Germany will aid the country's energy transition. Infrastructure contractors will also be kept busy by government plans to spend €40 billion by 2027 to improve the country's rail network, including the new U5 metro line in Hamburg.



“Any growth is likely to be seen in the infrastructure and mega-scale industrial sectors, where demand for labour and materials will remain high”

Poul Syratt
Senior Quantity Surveyor



FRANCE

The French construction market stabilised in 2023 but the outlook for 2024 is uncertain, especially now that investment in the Olympics is coming to a close

Data from INSEE showed the French economy grew by 0.9% in 2023 – a significant slowdown after increases of 2.5% in 2022 and 6.4% in 2021. Latest OECD projections indicate GDP growth will ease further to 0.8% in 2024, recovering to 1.2% in 2025.

Higher interest rates and elevated inflation continued to act as a drag on housing and commercial activity in 2023. Inflation is expected to drop from a high of 5.7% in 2023 to 2.7% in 2024. However, market conditions will take some time to improve, with the latest PMI update showing a sharp and accelerated fall in construction new orders for sectors sensitive to cost of finance.

The French construction sector is resilient, and latest INSEE surveys highlight a ‘stable’ business climate for the construction sector. This can largely be explained by continued investment in major public transport infrastructure projects that provide many contractors with a steady future pipeline of work. There are some bright spots in the commercial sector too, including demand for data centres.

However, even with demand cooling, delivery could still be impacted by a shortage of construction workers, with 79% of responses to a Jan 2024 construction survey saying they were experiencing recruiting problems.

From a net zero perspective, there is an increasing focus on improving energy performance within buildings. In housing, this is guided by the décret tertiaire, which targets a 40% reduction in energy consumption by 2030. within buildings.



“2023 was a year of partial market stability, boosted by a fall in inflation from a peaks in 2022. However, the continued war in Ukraine and the recent situation in the Middle East means that there is still likely to be uncertainty in the market in 2024”

Hassen Naifer
Senior Cost Manager, Places

UK

The UK’s public sector spending spree is slowing down, taking pressure off an overheated construction sector.

The UK’s growth trajectory is weak. GDP grew by just 0.1% in 2023 and Bank of England forecasts for 2024 and 2025 are only 0.25% and 0.75%, respectively. Interest rates reached a 15-year high of 5.25% in August 2023, and are expected to start falling in summer 2024.

Viability challenges have continued to affect projects, even as inflation has fallen. New regulations focused on low carbon emissions and improved building safety also created uncertainty and added to project costs. Uncertainty could continue in 2024, given local, mayoral and national elections are due in the coming months.

Tight fiscal conditions will see increasing pressure on the public purse in 2024 and beyond, with real-terms cuts in government capital investment currently projected until 2029. Tighter budgets will require a greater need for collaboration with the private sector to drive forward investment and regeneration in towns and cities.

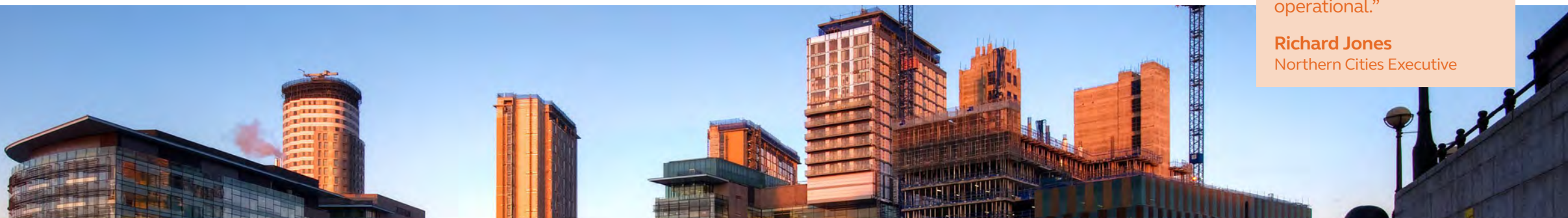
Whilst optimism as measured by the construction PMI has improved, the legacy of a weak order book from 2023 will delay recovery until late 2024 before the positive sentiment is realised. The infrastructure sector looks set to offer the greatest future opportunity, particularly investment in networks including energy transition projects and a large-scale, £96 billion planned investment in the regulated water sector. In both sectors, capacity constraints will contribute to higher inflation and may impact the ability to deliver all projects and programmes in the period.

Future spending on transport was thrown into chaos by the cancellation of later phases of the HS2 rail programme in 2023. Some of the funds will be redistributed across a wider range of programmes. City Authorities including Manchester have benefitted from the extension of regional transport funding for a further 5 years to 2032, totalling £8.8 billion.



“Our research shows that certainty and commitment to major infrastructure across the North will build investor confidence, resulting in a tangible increase in the scale and pace of regeneration across Northern cities and towns. Importantly, these benefits can be unlocked years before the infrastructure becomes operational.”

Richard Jones
Northern Cities Executive





“Divergent sector dynamics has seen shortages in some construction sectors like housing, being filled by capacity created in the decline of others, such as commercial. A stabilisation of energy and materials prices and inflation rates in 2024 are likely to be offset by anticipated labour price increases and continued high demand in the market.”

Fintan Kenny
Commercial Director

IRELAND

Although Ireland’s multinational trade caught a cold in 2023, the domestic market continued to grow, with the government able to continue investing in much needed public housing.

Ireland experienced a 3.6% contraction in real GDP growth in 2023, impacted by a large correction in export earnings from the vitally important pharmaceutical sector. By contrast, domestic demand including investment grew by 0.5%. Total growth for 2024 is forecast to be 2.4% according to the OECD, rising to 2.9% in 2025, as price pressures subside. Annual inflation in 2023 averaged 5.2% but is projected to ease to 2.2% in 2024 in line with the wider market.

The housing crisis is a huge problem in Ireland and 2023 saw 32,700 new dwelling completions, an increase of 10% on 2022, at levels not seen since the Celtic Tiger era. State intervention was needed to maintain output in the face of a weak for sale market. The public sector accounted for 40-50% of the completion total in 2023. High levels of public investment is likely to continue in 2024 as house sales remain weak and as PRS investors continue to face viability challenges. Institutional investors are instead focusing on social or student housing.

Commercial markets suffer from oversupply. The Dublin office vacancy rate was 17% in 2023, and 195,000 sq m of new space is in the pipeline, with only 25% pre-let. The previously booming data

centre segment is also slowing, but due to lack of grid capacity rather than weak demand. Work arounds include on-site energy generation or direct connections to offshore wind farms. Demand remains strong in the industrial and logistics sectors as vacancy rates for modern space remains at all-time lows.

It is difficult to directly attribute inflation of building costs to the introduction of net zero building standards, with inflation in 2023 in Ireland more directly linked to a shortage of skilled labour, rising labour costs, and supply chain concerns linked with overseas conflicts.



BELGIUM

Belgium's construction sector remained resilient in 2023 as demand for new work kept rising ahead of the wider economy.

The Belgian economy expanded by 1.5% in 2023, boosted by a rebound in corporate investment. GDP growth is forecast to reach 1.4% in 2024 and 1.5% in 2025. Inflation fell to 2.3% in 2023 as the energy price impact eased, although the removal of government measures to dampen price increases could see inflation bounce back to 3.5% in 2024.

The Belgian construction sector grew by 1.9% in 2023, slightly faster than the wider economy. This was due to pent-up post pandemic demand. However, momentum is falling, and indicators point to a slow-down in 2024.

For example, inflation and higher finance costs led to a 13% reduction in the number of building permits issued in the first ten months of 2023. This slowdown will particularly affect the residential sector in 2024.

In the renovation market, which accounts for almost 60% of total building production, high energy prices had encouraged many households to improve the energy efficiency of their homes. But as energy prices have come down, so that momentum is forecast to ease in 2024 as payback periods lengthen. Industry capacity will also be reduced by a record number of bankruptcies in the sector in 2023, albeit a large proportion of these firms (22%) are under three years old and have fewer than four employees.

On the upside, a further increase in public investment in infrastructure is expected this year as municipal investment ticks up ahead of local elections in 2024. This is to be welcomed as the country's roads and railways, for example, are outdated and in need of major refurbishment in the years ahead.



“There is some uncertainty in the Belgian market at present, but with outdated infrastructure putting pressure on political funding decisions, new contract formats are being investigated as a way of moving schemes from drawing board to site.”

Ann Van Melkebeek
Senior Cost Leader

SPAIN

Spain's construction market saw healthy output figures towards the end of the year and as interest rates fall in 2024, the hope is that more projects will pass the viability test.

Recent data indicates that the Spanish economy is showing resilience, in contrast to the sharp slowdown experienced in other eurozone countries. Spain's economy grew by 2.5% in 2023, a notable slowdown compared to the 5.8% growth seen in 2022, but much better than the near -zero growth seen by many European peers.

Business investment was boosted by investment in net zero and digitalisation activity and the continued rollout of the EU's Next Generation recovery funds. Latest Eurostat data suggests Spain saw a 5.6% increase in construction production in December 2023 compared to the same month in 2022.



It followed year-on-year monthly rises of 8.7% and 7.4% in October and November, respectively. The growth was despite the viability of some projects being impacted last year, as higher interest rates had a knock-on effect on debt-funded investors and on land valuations, forcing some to halt or delay schemes until metrics improved.

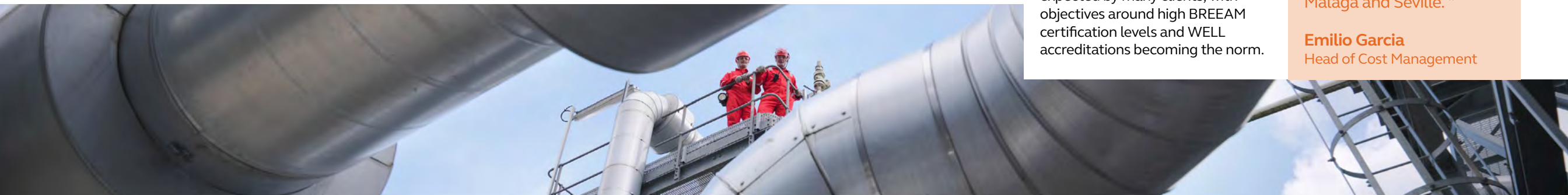
There is still evidence of clients taking forward schemes in the data centre and giga factory space, with such projects boosted by a significant cooling of construction costs over the past year. October figures from the National Bank of Spain showed construction costs were 0.6% lower than a year earlier.

The surge in internal sustainability targets from a few years ago has now levelled off and become expected by many clients, with objectives around high BREEAM certification levels and WELL accreditations becoming the norm.



“Market dynamics of high interest rates and higher than average inflation in 2023 led to project viability being questioned and projects being put on hold. But the strong desire for real estate development in Madrid and Barcelona meant that overall, growth was neutral across Spain. This trend will replicate in 2024, boosted by a surge in hospitality projects and activity picking up in other cities such as Valencia, Malaga and Seville.”

Emilio Garcia
Head of Cost Management



ASIA PACIFIC

AUSTRALIA

Australia's pipeline of work is strong across nearly all states, driven by public sector plans favouring social and transport infrastructure, together with requirements for the 2032 Olympic and Paralympic Games in Queensland.

Australia's economy grew at an annual rate of 1.5%, according to latest Reserve Bank of Australia forecasts, with headwinds such as high inflation and sharply higher interest rates leading to a sharp decline in real household disposable income.

Viability issues took hold in the construction sector in 2023 as rising construction costs put pressure on project bottom lines, leading to many schemes being delayed or cancelled. In the face of difficult markets, clients looked at alternative methods of construction, such as DfMA. Often it was more productive to focus on delivering cost certainty rather than trying to engineer a lower cost in a rising market.

In terms of sub-sector activity, data centres and industrial projects have been key standouts in Australia in terms of performance. Looking forward, Australia has a significant pipeline of work across nearly all states - heavily skewed by the public sector and focusing on social infrastructure and transport, in addition to work on the 2032 Olympics and Paralympics in Queensland. However, capacity has fallen, with construction insolvencies now well above the long-term trend, leaving questions about how the strong forward workload pipeline can be delivered.

There is growing movement towards low carbon design and construction, but in practice, these projects have only reached the feasibility and planning stages so far. In NSW, the newly-elected Minns government is doubling down on commitments to net zero by 2050 and providing significant investment into stimulating private sector participation into renewable energy - a trend which is likely to continue into 2024. It is also leveraging infrastructure projects to densify city development, with a growth in housing around new metro stations in Sydney likely to be a key feature in the next couple of years. Meanwhile, in Brisbane, infrastructure activity will ramp up as Olympic deadlines edge nearer.



“2023 saw rising insolvencies and diminishing capacity fuel further construction cost escalation and, while this has not been at the peak of 2022, it has continued to damage and reduce the margins for project viability. 2024 presents the construction industry with an opportunity to reset and work together to strengthen and improve our approach to project delivery.”

Matthew Mackey
Business Leader, Cost
& Commercial



MAINLAND CHINA AND HONG KONG

Infrastructure and industrial work were the mainstays of China's construction sector in 2023 as the turmoil surrounding the real estate market continued. There were signs of recovery in Hong Kong, and this could be further boosted by the public housing and public works sectors in accordance with the Chief Executive's 2023 Policy Address and Hong Kong Major Transport Infrastructure Development Blueprint, which aim to alleviate the housing and transportation problems.

China's economy officially saw growth of 5.2% in 2023, boosted by government support measures to help the ailing property market, which typically accounts for more than a quarter of economic activity. Officials set an ambitious 2024 GDP growth target of 5% in March. Hong Kong saw real GDP growth of 3.2% in 2023, following a contraction of 3.7% in 2022, as increases in inbound tourism and private consumption both saw an uptick. Current forecasts suggest growth of 3% in the Hong Kong economy in 2024.

China's policymakers are trying to cope with entrenched deflation, record-low levels of foreign direct investment and a meltdown in the property sector by focusing on high-end manufacturing and infrastructure investment. Indeed, construction output of mainland China saw growth of 5.8% in 2023, primarily driven by transport infrastructure and industrial projects. However, real estate investment declined by 9.6% and new-build real estate activity decreased by 20.4%, impacted by a property market debt crisis and bankruptcies of a number of China's major real estate developers.

As the Chinese economy is going through transformation, new drivers are emerging to shape China's growth path. Among these, green transition, urban renewal, and industrial upgrading are creating many new opportunities as efforts to meet targets in China's decarbonisation road map get underway.

The level of construction activity in Hong Kong showed signs of recovery in 2023, with the overall gross value of works performed seeing an increase across both the private and public sectors. In the year ahead, the level of construction activity in the public sector will still be supported by

projects with funding approved in the previous few years. Meanwhile, the performance of the private sector will depend on the pace of recovery of the property market. This could be boosted by recent announcements that the government will scrap additional stamp duties on transactions imposed in the last decade and that the Hong Kong Monetary Authority (HKMA) will raise the maximum amount homebuyers and investors can borrow.



“Levels of construction activity in the public sector will be maintained by the Hong Kong Government's efforts to increase public housing supply and their investment pledges for development in the Northern Metropolis. However, private sector activity will remain subject to the pace of recovery in the property market.”

Lysander Lam
Director, Quantity Surveying



Methodology

The Arcadis International Construction Cost Index covers 100 cities. The index is based on a survey of construction costs which covers 20 building functions. This data is supplemented by a review of market conditions in each city combined with the professional judgement of a global network of experts.

We collect indicative cost ranges for each building function for each city. The low and high range costs for each building type are converted into US Dollars (USD). They are normalized and indexed against the cost range for equivalent buildings in Amsterdam, where Amsterdam = 100. We calculate an index range for each city comprising the low and high values for each of the 20 building types.

The data was collected in the first quarter of 2024.

Costs used to calculate the index are based on buildings delivered to local specification standards, meeting both functional requirements and quality expectations. As a result, the index compares the relative costs of delivering the same building functions in a city, it also reflects the different levels of quality expectation reflected in a specification.

Costs covered in the index exclude land, demolitions, external works and services and risk allowances. This means that major sources of variability are removed from the index. Similarly, we exclude costs of professional fees and local sales taxes.

The index does not take into account purchasing power parity. The construction cost data used in the index is current as of 1st quarter 2024. The exchange rates used to calculate the index were current on 13th February 2024.

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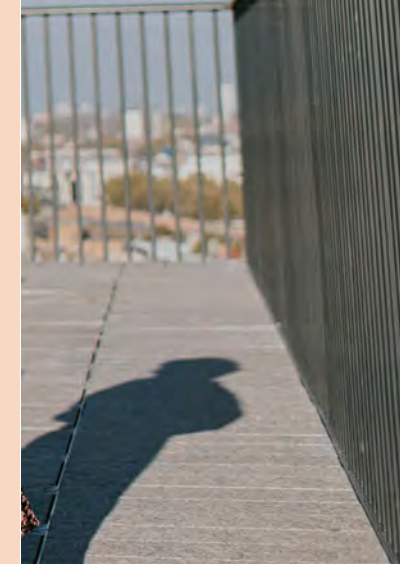
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Arcadis is the world's leading company delivering data-driven sustainable design, engineering, and consultancy solutions for natural and built assets. We are more than 36,000 architects, data analysts, designers, engineers, project planners, water management and sustainability experts, all driven by our passion for improving quality of life. As part of our commitment to accelerating a planet positive future, we work with our clients to make sustainable project choices, combining digital and human innovation, and embracing future-focused skills across the environment, energy and water, buildings, transport, and infrastructure sectors. We operate in over 30 countries, and in 2023 reported €5.0 billion in gross revenues.

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