

CONCRETE'S ENABLING ROLE IN BUILDING A SUSTAINABLE AND RESILIENT FUTURE

REPORT FOR THE GLOBAL CEMENT AND CONCRETE ASSOCIATION

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FOREWORD

Megatrends are reshaping the built environment. Demographic change, climate transition and resilience, geopolitical fragmentation and digitalisation are changing the scale and location of construction demand and the expected performance of the assets being delivered. Concrete is one of the most ubiquitous materials in the built environment. It is therefore in a critical position to deliver the broader economic, social and environmental objectives that underpin these trends.

In this context, Oxford Economics was engaged by the Global Cement and Concrete Association to prepare an independent report on the role of cement and concrete in a changing world. The report places the sector within the context of the major forces shaping the built environment, and provides an evidence-based perspective on how concrete supports fundamental economic and social objectives. In doing so, it is intended to inform policy engagement, stakeholder dialogue and industry discussion.

The decarbonisation of cement and concrete production is critical to the sector's future role. This report touches on the industry's objectives and the implications for future use, but does not seek to set out the full decarbonisation pathway. Further detail is provided in the [GCCA Concrete Future 2050 Roadmap](#).

To engage with this brief, the report focuses on three interlinked themes:

Section 1 sets out the global context, examining the emerging megatrends and their impact on the scale, location and nature of demand for infrastructure and housing. Section 2 then turns to the role of cement and concrete within this system. Section 3 brings these together into a set of strategic considerations.

A note on terminology: cement and concrete

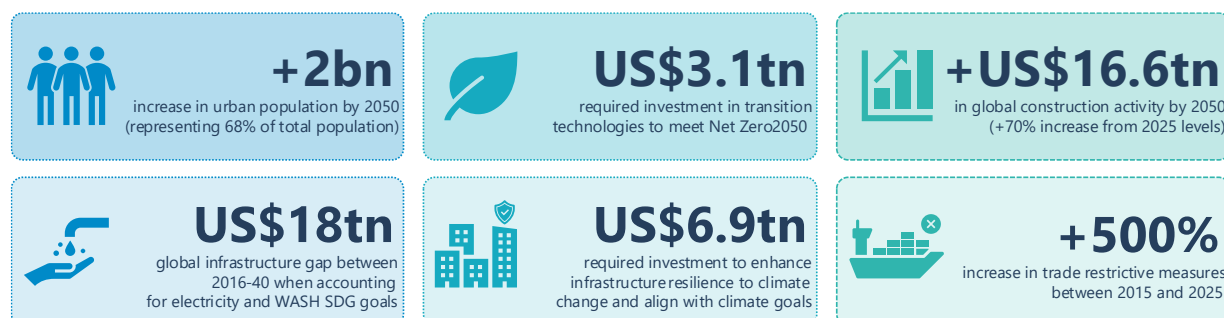
Cement and concrete are often discussed together, but they are different materials with different roles in construction. Concrete is the end-use material visible across the built environment, including in buildings, roads, bridges, dams, tunnels and other infrastructure. Its versatility, strength and durability have made it one of the most widely used materials in the construction industry.

Concrete is made from crushed rock, sand, water and cement. Cement acts as the binding ingredient in concrete, allowing the other materials to form a solid construction material.

For the purposes of this report, we generally refer to concrete because it is the material most directly visible in buildings and infrastructure. However, many of the issues discussed in the report apply to both cement and concrete, including demand, supply chains, resilience, policy and decarbonisation.

EXECUTIVE SUMMARY

The world is entering a period of profound economic, demographic, and environmental change. Rapid population growth, accelerating urbanisation, rising geopolitical tensions, the implementation of new technologies and increasing climate risks are placing unprecedented global demands on infrastructure and housing. Meeting these demands requires a heightened focus on both resilience and sustainability.



The cement and concrete industry has a critical role to play in enabling a more resilient, inclusive, and sustainable future. As one of the most widely used materials in the built environment, cement and concrete underpin the infrastructure, housing, and systems that support modern economies and rising living standards across both developed and emerging markets.

This Oxford Economics report outlines the megatrends driving increasing investment in infrastructure and housing and assesses the role that cement and concrete can play in meeting demand. It also considers strategic and policy implications: generating local economic benefits and capacity, increasing sovereign strategic resilience, and better management of industry and infrastructure risk whilst leaning into the sector's transition towards more environmentally sustainable production.

A world of rising physical demand

Established and emerging megatrends are driving rising investment in the built environment.

Urban population growth is driving development pressure and adding to existing infrastructure gaps. Emerging markets will lead new-build activity, while advanced economies focus relatively more on maintenance and upgrades to ageing assets. Climate change, the energy transition, and increasing physical risks require infrastructure assets to be more resilient and adaptable. Geopolitical shifts and digitalisation are further driving demand for strategic (including defence), energy, and high-tech infrastructure.

Together, these trends are transforming both the scale and composition of construction activity, with global construction activity to rise over 70% to US\$16.6 trillion by 2050 (from an estimated US\$9.7 trillion in 2025).

Cement and concrete have a critical strategic role to play in the built environment

Cement and concrete enable economic development, resilience and sustainability by underpinning infrastructure that raises living standards and supports productivity.

Scalability, durability and local availability make cement and concrete essential for affordable housing, transport, energy, and water systems. Because concrete is typically produced and supplied close to where it is used, this demand also supports local economies, jobs, and regional industrial capacity. They also enable decarbonisation while requiring emissions reduction, positioning them as a strategic industrial capability.

Strategic considerations

The key role of cement and concrete in meeting future growth in physical demand for infrastructure and housing presents several critical strategic considerations for the broader infrastructure industry, stakeholders and policymakers:

- Recognising the cement and concrete industry's positive social and economic contribution, particularly to regional and local communities
- Understanding how megatrends are reshaping infrastructure demand, including where and how assets are built and delivered
- Harnessing innovations to improve productivity outcomes in concrete design and manufacture, and supporting initiatives to increase productivity across the construction industry more broadly
- Integrating resilience alongside sustainability and decarbonisation, including the industry's role in delivering durable, long-life assets that can withstand growing climate and physical pressures, as well as enabling adaptation infrastructure such as flood defences and heat-resilient buildings.
- Embedding resilience considerations into insurance frameworks and infrastructure business cases to support reliable, future-ready assets
- Developing robust data systems and reporting to support evidence-based decisions on resilient, sustainable infrastructure
- Managing rising costs while maintaining capacity to meet growing global demand for infrastructure, housing, and adaptation assets

Consequently, it is critical that the cement and concrete industry is positioned as part of the solution to a more demanding global infrastructure challenge: enabling development, supporting resilience, strengthening communities, reducing emissions and maintaining the physical systems on which economies depend.

CONCRETE'S ENABLING ROLE IN BUILDING A SUSTAINABLE AND RESILIENT FUTURE

How rising global demand for infrastructure and housing is reshaping the role of cement and concrete

Global construction output projected to reach **US\$16.6 trillion** by 2050

1

1 RISING PHYSICAL DEMAND



A People, cities & development pressure

Population growth and urbanisation intensify demand for housing, transport, utilities and social infrastructure.



B Infrastructure gaps & housing deficit

Addressing infrastructure gaps will require a major programme of construction, renewal and upgrading, from replacing ageing assets in advanced economies to expanding basic services in emerging markets.



C Climate transition & resilience

Renewables, grids, electrification, water systems and adaptation assets raise the performance demands placed on infrastructure.



D Sovereignty & strategic resilience

Governments are investing in domestic capacity, strategic industries, defence-related assets and reconstruction capability.



E Digitalisation & high-tech infrastructure

AI, data centres and advanced manufacturing create demand for energy-intensive, highly serviced facilities.

Together, these megatrends increase both the scale and complexity of construction demand

2

2 WHY CONCRETE MATTERS

1 A platform for development



Concrete underpins housing, roads, rail, ports, schools, hospitals, water and sanitation systems.

2 An enabler of transition & resilience



Durability, scalability and local availability make it essential for urban growth, adaptation, energy and water systems.

3 A foundation for strategic capability



Cement and concrete support local jobs, regional activity, sovereign capacity and reconstruction.

Concrete is both indispensable to the built environment and part of the net-zero transition

3

3 STRATEGIC CONSIDERATIONS

1

Acknowledging & measuring social & local economic contribution

2

Understand where, what & how assets are built

3

Harnessing innovation & productivity

4

Embed resilience in insurance & infrastructure business cases

5

Manage costs while preserving capacity & reliable supply

6

Consider resilience alongside sustainability & decarbonisation

7

Strengthen data, standards & evidence-based reporting

Bottom line: the world will need more housing, infrastructure, adaptation assets, energy systems, digital infrastructure and reconstruction capacity. **Much of this will be difficult to deliver without concrete.**



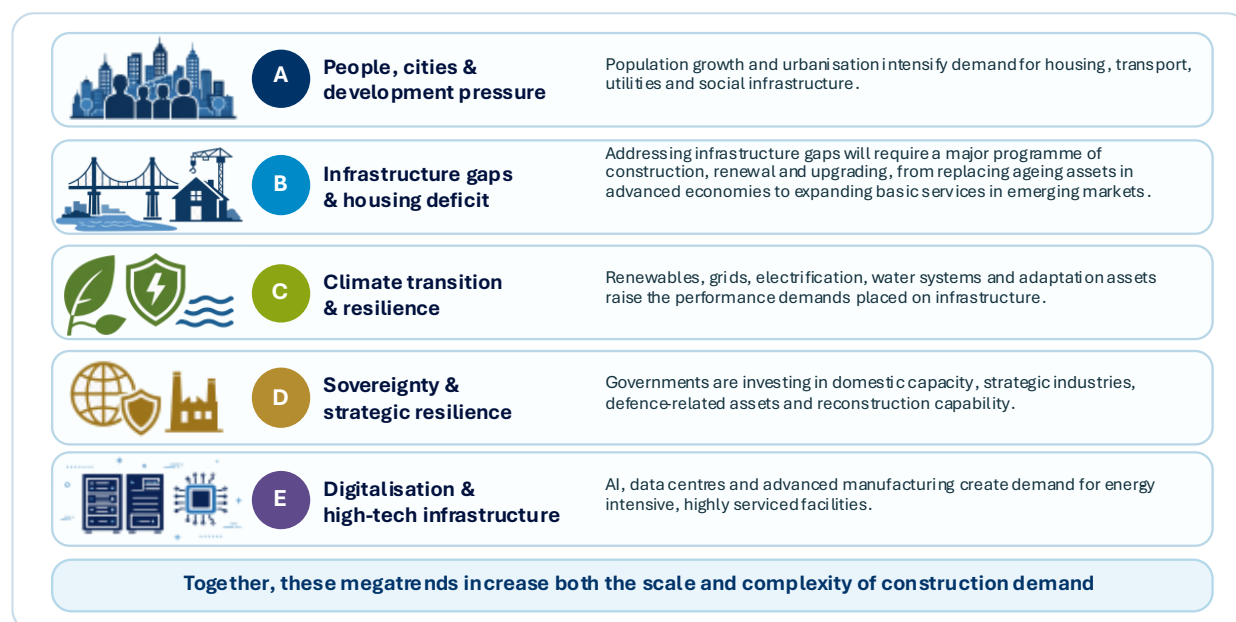
SECTION 1. RISING PHYSICAL DEMAND

1.1. INTRODUCTION

The global economy is placing increasingly intense physical demands on the built environment. The level of construction activity has almost doubled over the past 25 years and will continue to rise into the future. This reflects sustained growth in the built environment, but also a shift in the type of assets that are expected to be delivered.

Demographic change remains the foundation of the outlook. At its core, rising demand reflects that more people, living in more urbanised and interconnected societies, will require significantly more infrastructure, housing, and essential services. Beyond these structural demographic forces, the nature of demand is also evolving. The global infrastructure gap continues to widen as investment struggles to keep pace with rising requirements, including the role of climate change and physical risk in raising expectations for whole-of-life asset performance.

Figure 1: Megatrends shaping concrete demand



The energy transition has accelerated demand for emerging asset classes, which intersects with the physical requirements needed to support emerging digital infrastructure. Geopolitical uncertainty is reinforcing these pressures, with governments renewing their investment focus on domestic infrastructure, strategic industries and defence capabilities to enhance sovereignty capability.

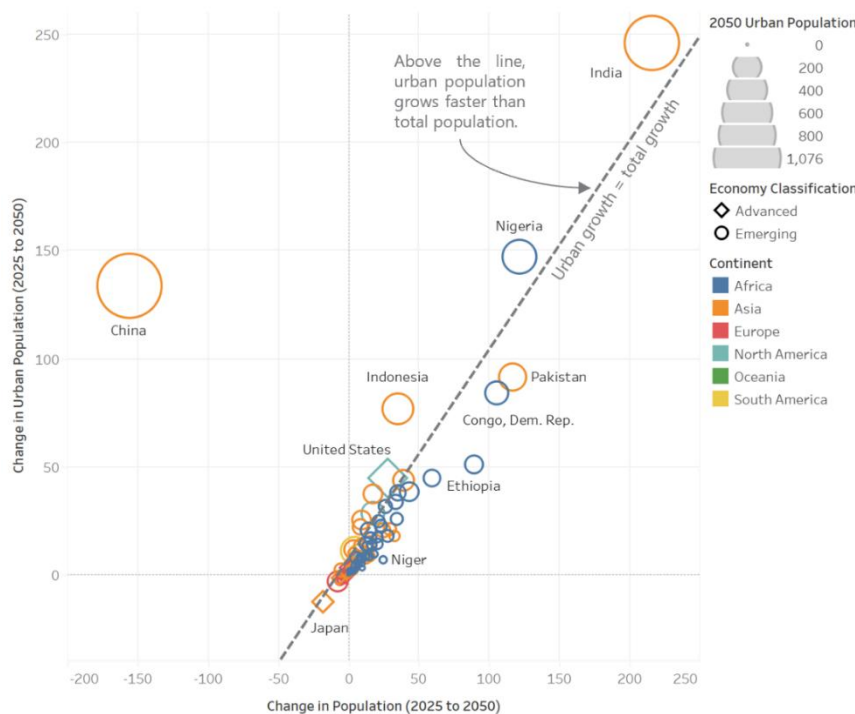
Taken together, these forces point to a sustained and broad-based expansion in global construction activity, although the pattern of growth will vary by region and asset type. In emerging markets, demand will be driven primarily by new-build construction, reflecting not only demographic change, but also the need to close longstanding deficits in housing and infrastructure provision. In advanced economies, the emphasis will shift toward renewal, resilience, and the optimisation of existing systems.

1.2. PEOPLE, CITIES AND DEVELOPMENT PRESSURE

Population growth will underpin increased demand for infrastructure and housing over coming decades. The global population is projected to reach 9.7 billion by 2050, up from 8.2 billion in 2025. Much of this growth will occur in emerging and developing economies, particularly across parts of Africa and Asia. This trend is not uniform within these regions, with advanced economies in Asia already facing population stagnation or decline. This demographic divergence creates different infrastructure challenges across regions.

In faster-growing emerging and developing economies, population growth will require continued expansion of infrastructure and housing to service basic needs. This is in addition to the need to close substantial pre-existing infrastructure gaps, discussed further in Section 1.3. In slower-growing and ageing economies, demand will shift towards asset repair and modernisation. These economies will need to maintain and upgrade legacy infrastructure while adapting infrastructure to the needs of older populations.

Figure 2: Total population and urban population growth to 2050



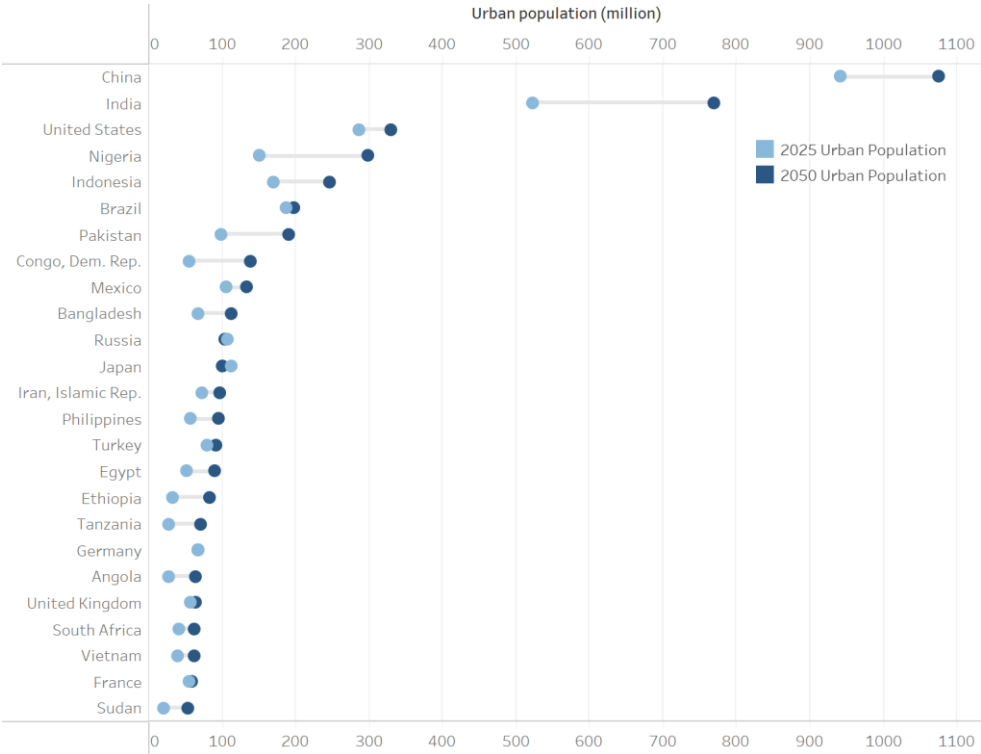
Source: World Bank WDI, United Nations, IMF, Oxford Economics

At the same time, the population is becoming increasingly urban. By 2050, the global urban population is expected to reach around 6.5 billion people (around 68% of the total population, up from 58% in 2025). The increasing prevalence of megacities, urban areas with over 10 million residents, highlights the global rise in urbanisation rates.

Analysis conducted by Oxford Economics indicates that the number of megacities will increase from 45 today to 66 by 2050, concentrated in Asia and Africa.

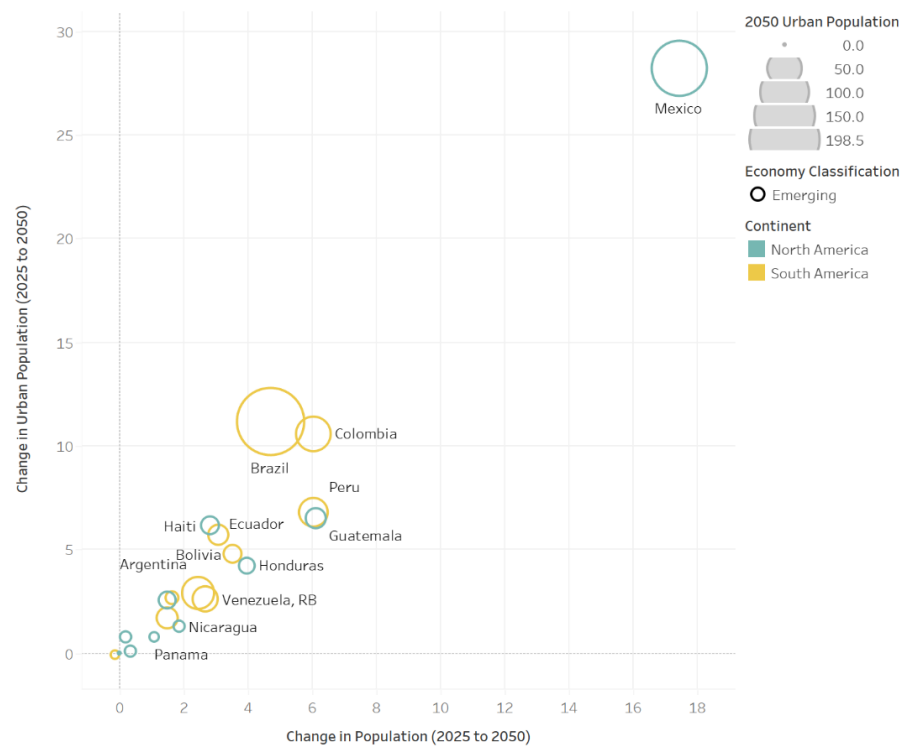
Dense urban populations require the provision of complex infrastructure networks. Well-planned urban infrastructure can improve economic and social mobility – while poorly planned or under-provided infrastructure can entrench informal development, inequality and increased climate vulnerability.

Figure 3: Change in urban population, 2025 to 2050, top 25 countries (by size of 2050 urban population)



Source: World Bank WDI, United Nations, IMF, Oxford Economics

Figure 4: Total population and urban population growth to 2050, Latin America



Source: World Bank WDI, United Nations, IMF, Oxford Economics

India Smart Cities Mission – Housing and Infrastructure Program

India illustrates the infrastructure pressures associated with rapid population growth and urbanisation. The country's urban population is projected to reach around 770 million by 2050 (up from 523 million in 2025), significantly increasing demand for housing and infrastructure services.

In response, the Government of India has implemented large-scale urban programmes, including the Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation. The Smart Cities Mission targeted 100 cities and mobilised more than ₹1.6 lakh crore of investment across transport, utilities and public space projects.

1.3. INFRASTRUCTURE GAPS AND THE HOUSING DEFICIT

Infrastructure investment and construction activity are falling short of what is required to support population growth, urbanisation and economic development.

The previous section set out the scale of future demand created by population growth and urbanisation. An additional challenge is that delivery is already failing to keep pace, with uneven access to basic services and inadequate housing supply.

The Global Infrastructure Hub's *Global Infrastructure Outlook*, produced with analysis by Oxford Economics, estimated a global infrastructure investment gap of around US\$15 trillion from 2016 to 2040.¹ The gap rose to around US\$18 trillion when selected Sustainable Development Goal (SDG) requirements for water, sanitation and electricity are included (see SDG 6 and SDG 7 in Figure 5).

Figure 5: Infrastructure delivery supports key UN Sustainable Development Goals

6 CLEAN WATER AND SANITATION 	Ensure availability and sustainable management of water and sanitation for all
7 AFFORDABLE AND CLEAN ENERGY 	Ensure access to affordable, reliable, sustainable and modern energy for all
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
11 SUSTAINABLE CITIES AND COMMUNITIES 	Make cities and human settlements inclusive, safe, resilient and sustainable
13 CLIMATE ACTION 	Take urgent action to combat climate change and its impacts

¹ Global Infrastructure Hub "Global Infrastructure Outlook" July 2017

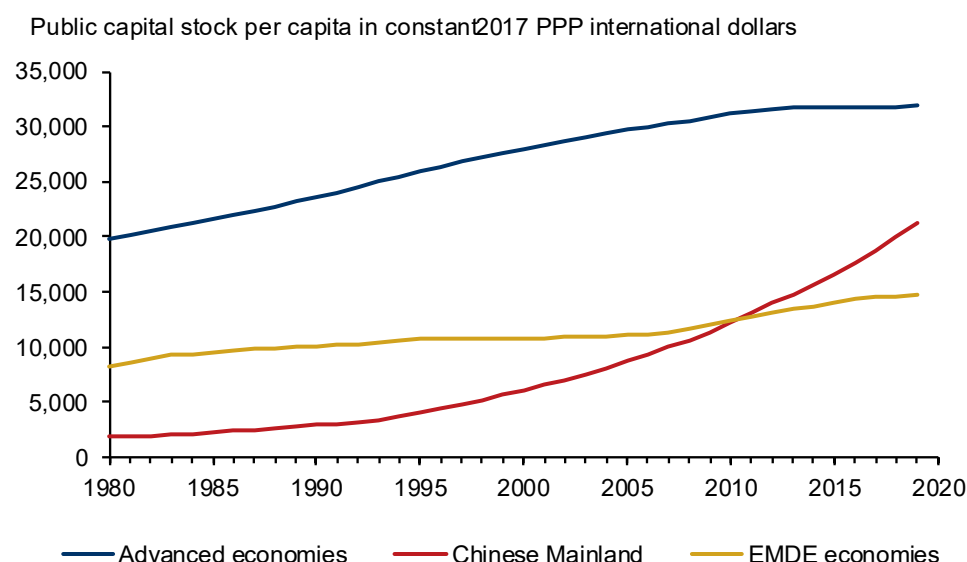
The SDGs are a set of 17 global goals adopted by the United Nations to end poverty, protect the planet and promote prosperity and well-being by 2030. They encompass a variety of issues including economic opportunity, environmental sustainability, inequality, and security. Many of these goals are advanced through construction and improvements to the built environment.

Infrastructure spend has not kept pace evenly across the world.

Long-term trends show distinct cycles of acceleration in some regions while others continue to fall behind, leaving wide divergences in housing and infrastructure provision. Differences in capital stock reflect varied levels of industrialisation and the capacity to sustain infrastructure expansion over time.

General government capital stock per capita is a useful proxy for the accumulated public infrastructure asset base (see Figure 6). On this measure, emerging and developing economies remain far below advanced-economy levels. Emerging and developing economies would need to increase their public capital stock per capita by around 2.2x to close the gap with advanced economies. Closing these gaps would require sustained, multi-decade capital accumulation rather than incremental increases. China provides the clearest example of the scale and persistence of investment required, having dramatically increased its public capital stock per capita since the 1990s.

Figure 6: General Government capital stock per capita



Source: IMF, United Nations, Oxford Economics

Disparities in capital stock and investment intensity are visible in both access and quality metrics, highlighting persistent gaps not only in emerging and developing economies but also advanced markets. Emerging and developing economies are challenged by infrastructure systems underdeveloped relative to population size and economic activity. Delivery often struggles to keep pace because of constrained public finances, underdeveloped capital markets and limited delivery capability.

For example, paved roads across the entire African continent account for 1.5% of the global total despite comprising 20% of the world's land mass. The entire African rail network spans around 80,000 km, which is only slightly larger than the Indian rail network despite Africa's landmass being 9-times larger.²

² Africa Finance Corporation, "State of Africa's Infrastructure Report (2024)", 2024

Renewable share of installed capacity is below 10% in the Middle East and below 50% for Africa, Asia Pacific and the Americas.³ Figures from 2023 indicate that only 79% of the global population had access to electricity, dropping as low as 60% in African nations. Water and sanitation challenges persist, with exposure to unsafe drinking water around 70% in the lowest-performing countries in Asia and Africa. Digital penetration gaps are pronounced, with internet penetration of 39% and 68% in Africa and Asia respectively, compared to over 95% in Europe and North America.⁴

Advanced economies typically benefit from a deeper stock of infrastructure built up over generations. However, over-reliance on older systems has left maintenance and reinvestment expenditures lagging. The challenge is shifted towards the maintenance, upgrading and adapting of existing networks, while also delivering new infrastructure to meet underlying social and economic goals. We include two case-studies below which highlight the role of rehabilitation in advanced economies.

US Dams – Ageing Infrastructure and Rehabilitation Demand

The US National Inventory of Dams includes more than 92,000 dams, with an average age of 65 years. Many of these assets were built under earlier design standards and now face changing requirements relating to safety, maintenance and climate exposure.

The American Society of Civil Engineers (ASCE) 2025 Report Card for America's Infrastructure rated US dams at D+. Nearly 17,000 dams in the National Inventory of Dams are classified as high-hazard potential, meaning failure could result in loss of life and significant damage to property. ASCE reported that more than 2,500 high-hazard potential dams were in poor or unsatisfactory condition.

The scale of the rehabilitation task is significant. The Association of State Dam Safety Officials estimated in 2025 that rehabilitating non-federal dams in the US (around 89,000 dams) would cost US\$165 billion.

Japan National Resilience Plan – Infrastructure Renewal and Upgrades

Japan illustrates how infrastructure priorities differ in mature, highly urbanised economies. Japan faces significant demographic decline, heavily shifting the focus to maintaining and extending the service life of existing assets. In 2019, Japan's Ministry of Land, Infrastructure, Transport and Tourism estimated that by March 2033, assets aged 50 years or older would account for 63% of highway bridges, 42% of tunnels, 62% of river management facilities, 21% of sewerage pipes and 58% of port and harbour quays.

This asset-age profile has contributed to greater policy emphasis on preventative maintenance, lifecycle management and disaster-resilient infrastructure. Japan's Implementation of National Resilience calls for more than ¥20 trillion of public and private investment over five years from 2026.

³ IRENA, "Renewable capacity statistics", 2025

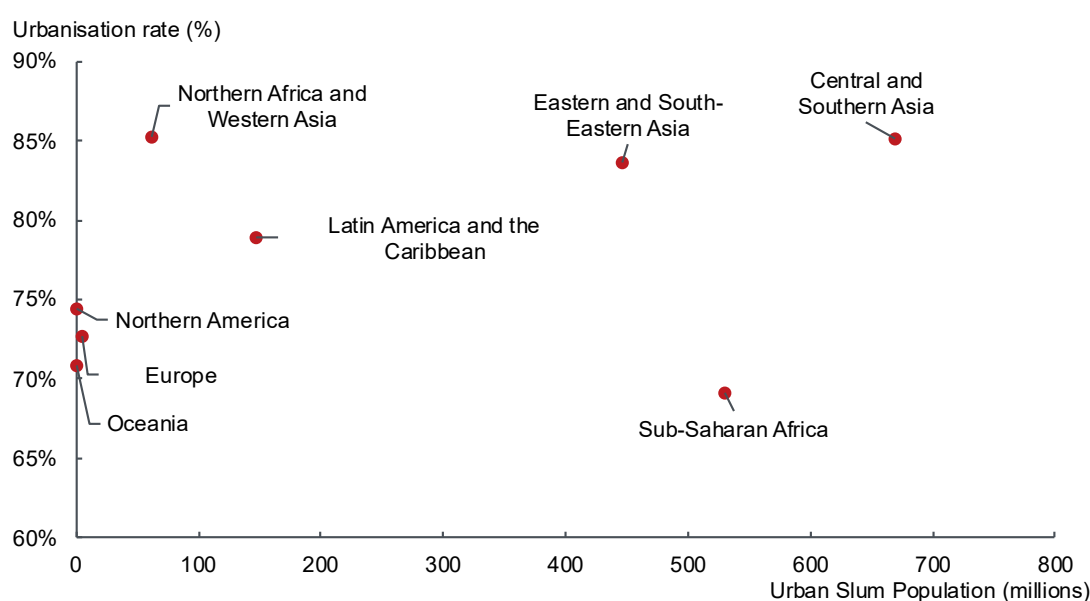
⁴ World Economic Forum, "Global Competitiveness Index", 2019

Housing supply is failing to keep pace with population growth and urbanisation – more than 2.8 billion people globally face some form of housing inadequacy.⁵

Alongside the inadequate provision of infrastructure, there is a large and persistent housing gap. Burgeoning informal settlements are a response to housing shortages and affordability constraints, historically being the main source of housing supply in regions with a high proportion of low-income nations such as Africa.

The pressure is felt across levels of development. Advanced economies face challenges with affordability, limited land availability and limited delivery capacity. Emerging and developing economies face more acute shortages, with rapid population growth and urbanisation expected to contribute to pre-existing shortages. The result is overcrowding and informal settlements that have limited access to basic utilities and other services.

Figure 7: Urbanisation rates and housing inadequacy by region



Source: United Nations, Oxford Economics

Nigeria Housing Expansion and Informal Settlement Pressures

Nigeria illustrates the interaction between population growth, urbanisation, housing deficits and formal housing-market constraints. The country's housing deficit is estimated at around 28 million units, while 48% of the urban population was living in slums or informal settlements in 2022. Affordability is a central issue, exacerbated by limited access to housing finance (just over 50% of Nigerians have access to banking). This shifts housing development into informal markets, which are less likely to be linked to basic services (e.g., sanitation, electricity, transport).

⁵ United Nations Human Settlements Programme (UN-HABITAT), "Adequate housing for all" 2024

⁶ World Bank "Case Studies on Islamic Finance for Asset Recycling" Accessed 2026

1.4. CLIMATE TRANSITION AND RESILIENCE PRESSURES

Infrastructure demand in coming decades will be shaped by two connected climate imperatives. The first is the need to build the physical systems required for the energy transition. Reaching net zero will require a large build-out across the electricity grid, industrial base and transport networks that enable lower-emissions activity.

The second is the need to strengthen existing and new assets so they can withstand increasingly frequent and severe climate-related shocks. The existing asset base will need to be made more resilient to rising temperatures, sea-level rise and natural disasters. Together, these forces will materially change the scale, composition and performance requirements of future construction demand.

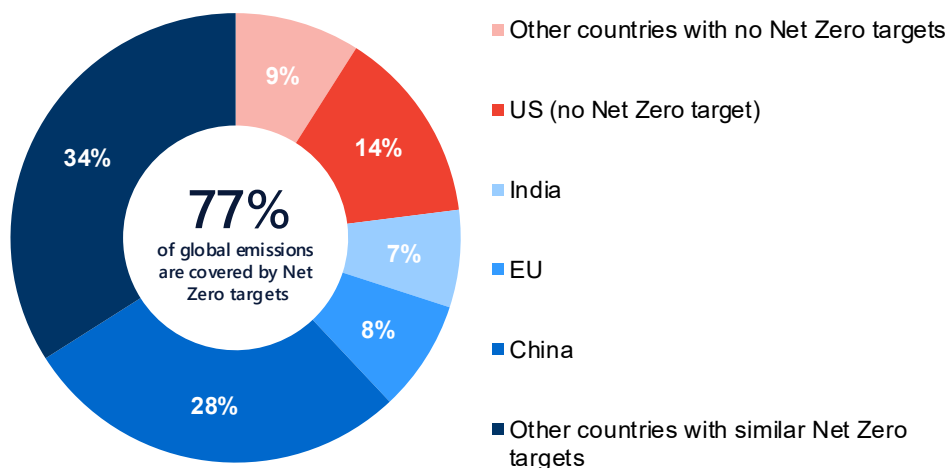
1.4.1. THE SYSTEM-WIDE TRANSITION

The transition to a low-carbon economy will require a major reconfiguration of global infrastructure systems.

For the electricity grid, this includes the deployment of renewable energy generation and the expansion of transmission and distribution networks. This also includes the electrification of transport and industrial processes, and the development of complementary hydrogen and CO₂ transport and storage infrastructure.

Policy ambition has increased, but delivery remains uneven. The Paris Agreement provides the overarching framework for limiting global warming, and many countries have announced net zero targets. As of October 2025, around 77% of global emissions were covered by announced or planned net zero targets⁷. However, only 8% of countries assessed had targets rated as “good practice” based on the scope and credibility of the plan⁸.

Figure 8: Global emissions covered by Net Zero targets



The gap between policy ambition and actual outcomes is shifting the required build-out into a narrowing period of execution. Unclear policy, weak project pipelines and limited delivery capacity can delay the assets needed for decarbonisation. At the same time, policy instruments such as carbon pricing can raise material costs and affect the affordability of infrastructure delivery.

⁷ Climate Action Tracker, “CAT net zero target evaluations”, October 2025

⁸ *ibid*

Investment is rising but remains below what is required. Meeting net zero ambitions by 2050 is estimated to require annual investment of around US\$3.1-5.8 trillion, compared with US\$2.4 trillion recorded in 2024^{9,10}. Investment is also highly uneven. Only 2% of the record US\$807 billion invested in renewable generation reached the least developed countries, despite these economies often facing the largest infrastructure deficits and highest climate vulnerabilities.

Much of this investment will flow into physical assets, including the transition of the electricity grid, which currently accounts for more than 40% of energy-related emissions. This will require new renewable generation alongside major upgrades to transmission and distribution networks. The IEA estimates that meeting climate targets will require an additional 80 million kilometres of electricity grid by 2040, equivalent to the size of the existing global grid network.¹¹

Electrification is reshaping demand in end-use sectors. In transport, the shift toward electric vehicles depends on a rapid expansion of charging infrastructure, grid expansion and supporting facilities. More than 1.3 million public charging points were added globally in 2024, a 30% annual increase¹², but the global stock of chargers will still need to increase fourfold by 2030 and tenfold by 2035 under stated policies.

Buildings are also central to the transition. Operational energy use remains a major source of emissions. Legacy building stock will require extensive renovation to improve energy performance. In the European Union (EU), for example, roughly 75% of buildings have poor energy performance¹³, while annual renovation rates remain well below the pace required to meet climate targets¹⁴.

For new builds, the transition will also require a reduction in embodied carbon in construction materials. Building codes and procurement frameworks are placing greater weight on embodied emissions, creating pressure to reduce carbon intensity without compromising durability, affordability or resilience. For cement and concrete, this reinforces the importance of the industry's decarbonisation pathway, as set out in the Concrete Future 2050 Roadmap.

1.4.2. CLIMATE RESILIENCE AND ADAPTATION STRATEGIES

The physical impacts of climate change are already placing stress on infrastructure systems.

Rising temperatures, changing rainfall patterns, sea-level rise, drought, wildfire and more intense storms will increasingly affect asset performance and maintenance cycles. This is also a development challenge. Rapid or informal urban development increases vulnerability to natural disasters (e.g., urban expansion into areas exposed to higher landslide or flooding risk).

This is changing both how infrastructure is built and what needs to be built. Existing assets will need to be maintained, upgraded or replaced to withstand harsher conditions. New infrastructure will increasingly need to be designed for more demanding operating conditions.

Transport infrastructure provides a clear example. Higher temperatures can accelerate deterioration in roads and rail systems, while intense rainfall and flooding can damage network infrastructure (e.g., pavements, bridges, tunnels, drainage). In the US, climate-related damage to paved roads could generate up to US\$20 billion in repair costs by the end of the century¹⁵. Globally, annual average flood losses are already estimated at US\$388 billion and could rise to US\$439 billion under a high-emissions scenario.¹⁶

⁹ IEA, "Net Zero by 2050", May 2021

¹⁰ IRENA, "World Energy Transitions Outlook 2024", 1.5°

¹¹ IEA, "Electricity Grids and Secure Energy Transitions", October 2023

¹² International Energy Agency, "Global EV Outlook 2025", 2025

¹³ European Commission, "Energy Performance of Buildings Directive", 2023

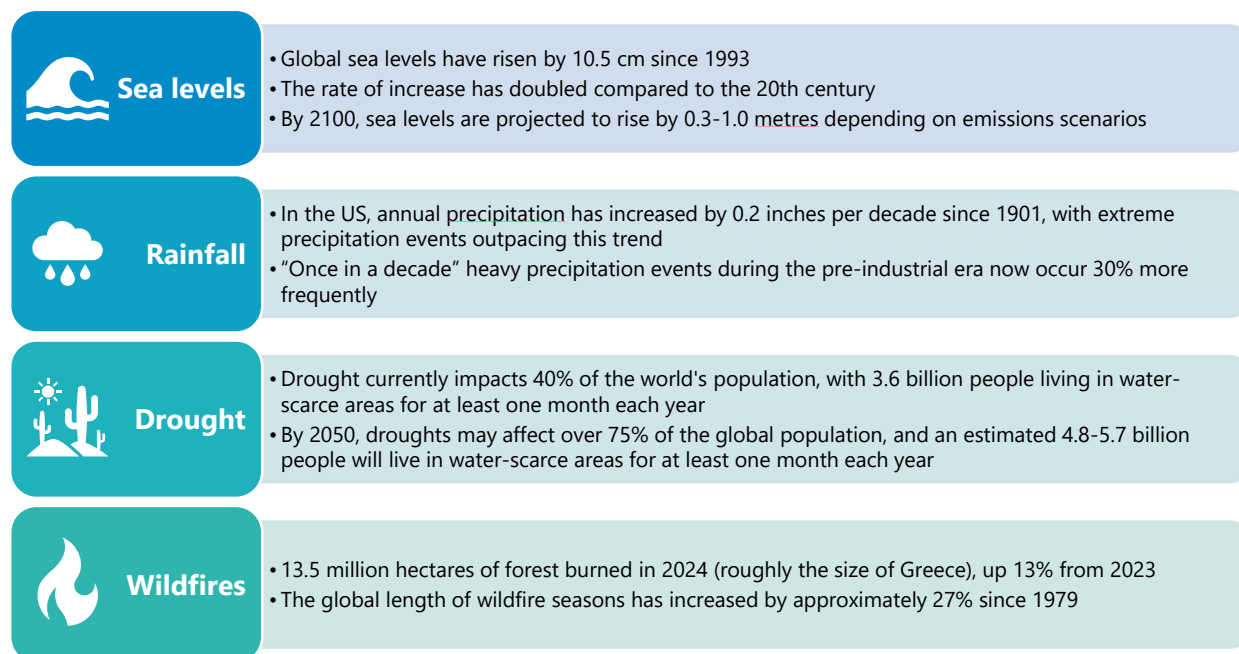
¹⁴ IEA, "Net Zero by 2050 – A Roadmap for the Global Energy Sector", May 2021

¹⁵ UN Disaster Risk Reduction, "Climate change threatens public transportation and water systems", September 2024

¹⁶ UN Disaster Risk Reduction, "Global Assessment Report", 2025

Climate adaptation is also increasing demand for new infrastructure, particularly in higher-risk regions. Water stress has already led to expanding desalination and recycling infrastructure in scarce regions, with Middle East and North Africa holding ~70% of global desalination capacity¹⁷. Population growth and increasing industrial uses of water, in addition to rising temperature levels, will exacerbate existing shortages.

Figure 9: The physical impacts of climate change



Source: NOAA¹⁸, Centre for Climate and Energy Solutions¹⁹, UNDRR²⁰, WHO²¹, World Resources Institute²², CSIRO²³

Coastal and flood-prone regions are investing in large-scale protective infrastructure. The Netherlands Delta Programme provides an example of a comprehensive adaptation strategy – combining dikes, storm surge barriers, levees and pumping stations to protect against flood risk. Similar approaches are visible in Venice's MOSE flood barrier system, China's sponge cities and Indonesia's planned capital relocation from Jakarta to Nusantara.

Climate change presents significant risks and opportunities to global economic outcomes and well-being. As seen in Figure 10, Oxford Economics modelling shows that a smooth net zero transition could leave global GDP around 12% higher by 2060 than under the baseline scenario. By contrast, in a severe downside scenario where governments fail to meet climate targets, global GDP could fall 35% below baseline by 2060. Rising climate losses are already affecting the affordability and availability of insurance. Total economic losses from natural catastrophes reached US\$318 billion in 2024, of which 60% were uninsured.²⁴

¹⁷ European Commission, "Desalination", Accessed April 2026

¹⁸ NOAA <https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>

¹⁹ Centre for Climate and Energy Solutions <https://www.c2es.org/content/extreme-precipitation-and-climate-change/>

²⁰ UNDRR <https://www.undrr.org/gar/gar2025/hazard-exploration/floods>

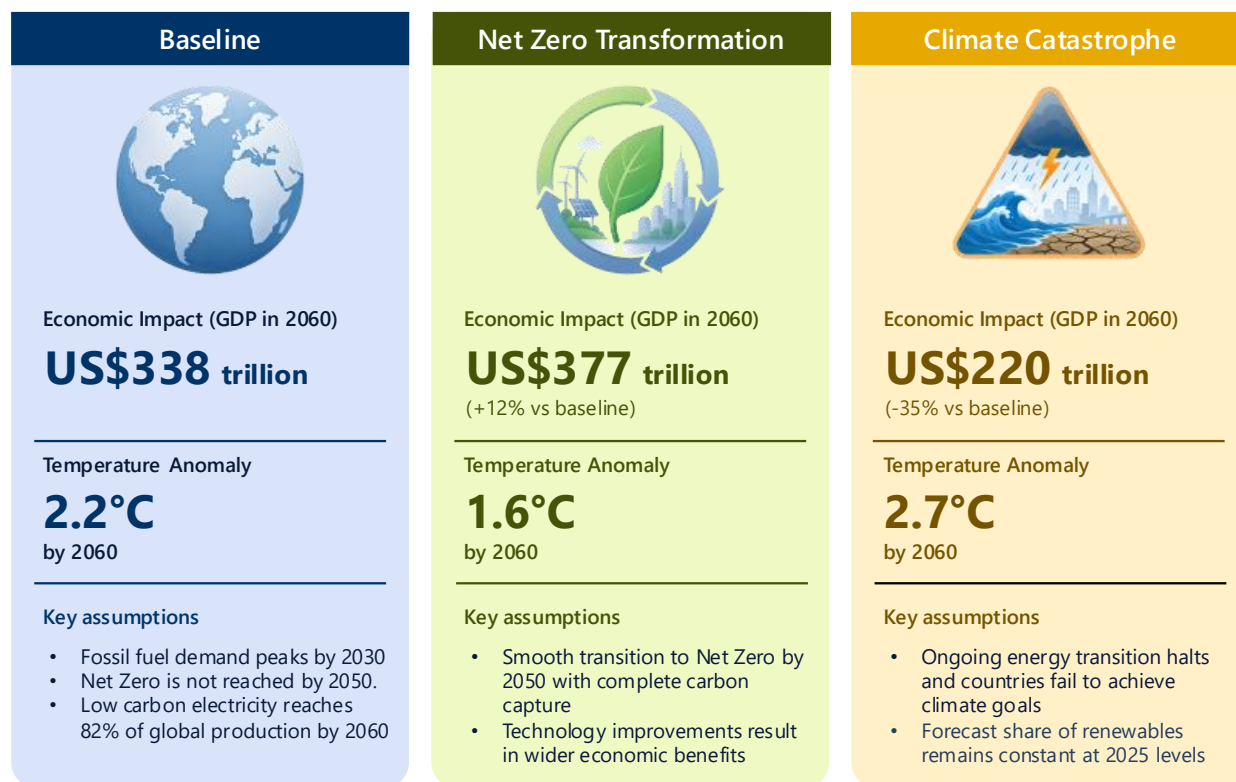
²¹ WHO <https://www.who.int/health-topics/drought>

²² World Resources Institute <https://www.wri.org/insights/global-trends-forest-fires>

²³ CSIRO <https://www.csiro.au/en/news/All/News/2022/July/Extreme-fire-weather-days-in-Australia>

²⁴ Swiss Re Institute, "Natural catastrophes: insured losses on trend to US\$145 billion in 2025", April 2025

Figure 10: Economic impact of climate scenarios



Note: GDP figures are in 2015 prices
Source: Oxford Economics

Netherlands Delta Works – Coastal Protection and Climate Adaptation Infrastructure

The Netherlands' Delta Works provide an example of large-scale adaptation infrastructure in a country with significant exposure to coastal and river flooding. The Eastern Scheldt Barrier is a 9 km storm-surge barrier in Zeeland, connecting Schouwen-Duiveland and Noord-Beveland. Around 3 km of the structure can be closed when high water threatens.

The barrier consists of concrete piers with movable sluice gates between them. Under normal conditions, the gates remain open to preserve tidal flows and the saline water environment. When water levels are expected to rise above three metres above Normaal Amsterdams Peil (roughly equivalent to the average North Sea level), all 62 floodgates can be lowered from the control centre, with the closure process taking around 75 minutes.

The asset illustrates the role of concrete in coastal defence structures that require durability and hydraulic performance under changing climate conditions.

1.5. SOVEREIGNTY AND STRATEGIC RESILIENCE

Rising geopolitical tensions, economic fragmentation and security concerns are driving a renewed policy focus on sovereign capability and defence. Systemic shocks including the Covid-19 pandemic, global logistics disruptions, and escalating geopolitical conflicts have exposed the vulnerability of global supply chains.

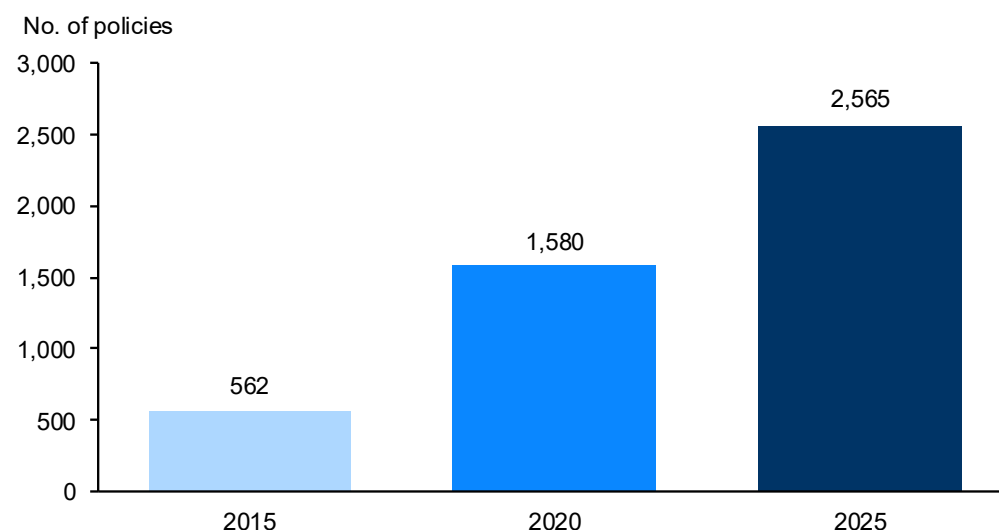
In response, governments are increasingly prioritising domestic capacity and capability. These policy shifts span across the defence sector and the industrial base, including the infrastructure required for key inputs such as critical minerals and energy generation. Geopolitical fragmentation is accelerating this shift. The number of trade restrictive measures has increased approximately fivefold since 2015 (from 560 to over 2,500), while the pace of growth of new trade agreements has halved compared to the 2000s.²⁵

Governments are actively promoting nearshoring and domestic production through trade restrictive measures and investments in sovereign manufacturing and logistics capability.

The sectoral focus of industrial policies and trade restrictive measures has shifted significantly. Restrictive measures on medical goods increased in prevalence during the Covid-19 pandemic, which has now moved towards military and digital applications. Policy measures are increasingly aimed at military products, semiconductors and low carbon technology – with these accounting for more than 60% of trade-distorting policy in 2023.

Major global economies have implemented national industrial policies aimed at reinforcing domestic capacity in critical sectors such as defence, renewable energy and advanced manufacturing. Figure 11 illustrates active policy in the EU, US and China. These sectors are inherently infrastructure intensive, requiring the development of industrial hubs, transport corridors and supporting grid capacity.

Figure 11: Number of trade-distorting policy measures



Source: Global Trade Alert, World Bank

²⁵ World Bank, "Global trade's rollercoaster ride", December 2025

Figure 12: Industrial resilience policies among major trading powers

	 15th Five-Year Plan (2026-2030) - Dual circulation strategy	 America First / Made in American Industrial Policy	 EU Strategic Autonomy Agenda
 Policy objective	Reinforcing technological self-sufficiency, upgrading domestic industrial base, and promoting domestic consumption, while remaining open but selective with international trade and investment	Reshore manufacturing to reduce reliance on foreign supply chains and strengthen domestic capacity in strategic and security critical sectors	Reduce strategic dependencies and rebuild European industrial capacity, positioning the region as a global leader in technology and renewables
 Approach	- Cultivating new quality productive forces (NQPFs) to modernise traditional and emerging industries through R&D investment growth target of >7% p.a. - Building a unified national market by dismantling provincial protectionism and standardising regulations - Expansion of green technology leadership through battery investment, renewable generation, and green hydrogen.	- Build America, Buy America Act: domestic content procurement requirement for public infrastructure projects - One Big Beautiful Bill: tax relief and investment incentives to boost domestic manufacturing including 100% tax deductions for R&D, and restrictions against exports from designated countries - CHIPS act (~US\$280 billion until FY27)	- Clean Industrial Deal: over €100 billion to support EU-made clean manufacturing - Green Industrial Plan: enhancing EU's manufacturing capacity for net-zero technologies and critical raw materials value chain through attracting investments and improving funding access for clean technology projects. - EU Chips Act: strengthening EU's semiconductors ecosystem with € 43 billion of investment - EDIP / Readiness 2030: €1.5 billion in grants between 2025-2027 to enhance munitions and military technology manufacturing abilities
 Industry focus	Renewables, semiconductors, industrial machinery, advanced materials, biotechnology, and foundational software	Semiconductors, advanced manufacturing, batteries, critical minerals, defence, aerospace and strategic manufacturing	Clean technologies, hydrogen, batteries, grid and storage technologies, semiconductors, steel and energy-intensive industries, critical raw materials and defence equipment

Source: [National Development and Reform Commission](#), [White House](#), and [European Commission](#)

At the same time, geopolitical tensions are driving sustained increases in defence spending and associated infrastructure investment. Measures of geopolitical risk, such as Caldara and Iacoviello's Geopolitical Risk Historical Index (GPRH), have risen sharply since Russia's invasion of Ukraine in 2022. As of April 2026, the GPRH sits 240% above January 2000 levels, almost equivalent to the ratings observed during the September 11 attacks and the beginning of the Iraq War. This increase in perceived geopolitical risk is being matched by a material rise in global military expenditure, which has increased from approximately US\$325 per capita in 2022 to US\$434 per capita in 2025 (+33%).

Military expenditure includes physical infrastructure investment. Across member countries of the North Atlantic Treaty Organisation (NATO), infrastructure accounted for roughly 2.5% of total military expenditure in 2024. While this is a relatively small share, it still represented more than US\$36 billion in outlays. The US accounts for the largest share of this, with military construction totalling US\$17.5 billion in 2025.²⁶

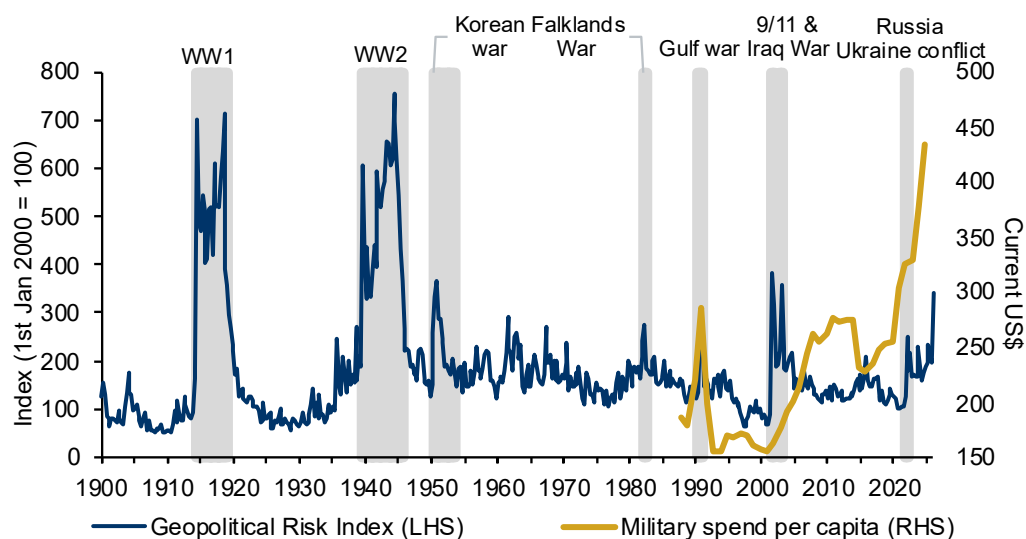
Infrastructure is also becoming more prominent in Europe's approach to defence and sovereign resilience. Dual-use assets can strengthen domestic infrastructure networks while also supporting military mobility and preparedness. This is reflected in NATO's commitment to increase defence spending to 5% of GDP by 2035, with 1.5% of GDP reserved for broader security-related investments, including infrastructure. Our estimates suggest NATO infrastructure spending is currently equivalent to around 0.7% of GDP. Meeting the new target would therefore imply a potential doubling of infrastructure-related defence spending as a share of GDP.

Geopolitical conflict can also significantly impact the built environment and cause acute reconstruction needs. Reconstruction and recovery needs in Ukraine are estimated to reach almost US\$590 billion over the next 10 years,²⁷ with a large proportion allocated to rebuilding transport networks (over US\$96 billion), energy (US\$91 billion), and housing (US\$90 billion).

²⁶ US Congress, "FY2026 Military Construction Appropriations: A Summary", August 2025

²⁷ United Nations, "Ukraine: US\$588 billion recovery cost over the next 10 years", February 2026

Figure 13: Geopolitical Risk Index and military expenditure



Note: LHS = left hand side, RHS = right hand side

Source: Economic Policy Uncertainty, Stockholm International Peace Research Institute

1.6. DIGITALISATION AND HIGH-TECH INFRASTRUCTURE

Digitalisation is creating new physical infrastructure needs. The growth of artificial intelligence and advanced manufacturing is increasing demand for data centres and high-tech facilities. These assets, in turn, require substantial investment in supporting infrastructure, including fibre networks and electricity and water supply. These linkages highlight how infrastructure demand is becoming increasingly interconnected: growth in one asset class depends on investment in others.

Data centres are the clearest example. Oxford Economics modelling indicates that global data centre investment has almost tripled since the late 2010's and is entering a materially larger phase of spending over the next 25 years – underpinned by cloud integration, broader adoption of AI and the growing reliance of service-based economies on data processing and connectivity. The US is the global leader in capacity and investment, while new capacity growth is shifting towards new frontiers in Asia Pacific and the Middle East.

This growth requires large and reliable electricity supply, but availability is a limiting factor. The International Energy Agency projects a 286% increase in installed data centre capacity between 2024 and 2035²⁸. Meeting this growth will require significant investment in generation and grid infrastructure. Water network infrastructure is also relevant. Data centres rely on water-based cooling, which will require network improvements – particularly in aforementioned regions already exposed to scarcity risk.

Advanced manufacturing provides an analogous trend. Semiconductor fabrication plants, battery factories, clean-technology manufacturing facilities and high-specification industrial buildings require large capital-intensive construction programmes. They also require high levels of energy reliability, water management, transport connectivity and supply chain access.

In parallel, traditional infrastructure sectors are becoming more technologically integrated, requiring investments in digital systems as well as physical upgrades to legacy asset classes. Sensor networks and automated control systems are increasingly integrated into roads, railways and utility systems. For example, the development of smart mobility corridors equip road networks with fibre optics and sensors to enable connected vehicles to communicate with highway infrastructure and facilitate autonomous mobility.

²⁸ International Energy Agency, "Energy and AI Observatory" 2025

1.7. THE EXECUTION CHALLENGE

The megatrends outlined in this section point to a sustained increase in demand for infrastructure and housing. However, the central challenge is actually delivering on the infrastructure needed for the aforementioned policy goals and social imperatives. Higher levels of construction activity require the increasing mobilisation of finance – while delivery requires material availability and expanding workforce capacity.

Gaps between required and actual capacity have become more acute since the pandemic. Delivery is constrained by fiscal pressures, planning complexity, labour shortages and higher project costs. This challenge is compounded in emerging and developing economies, which face heightened infrastructure and housing needs. At the same time, delivery is constrained by shallow capital markets, weaker planning systems and shortages of technical capacity. Access to finance remains a major barrier, with a lack of bankable projects placing pressure on public budgets and slowing project execution.

These constraints matter as delays have cumulative economic and social costs. Under-delivery of housing worsens affordability pressures and can expand informal settlement growth. Slow delivery of transport, water and sanitation infrastructure limits productivity, public health and market access. Insufficient energy infrastructure can delay electrification and the deployment of low-carbon technologies and other critical assets. Failure to invest in climate adaptation and resilience can increase future disaster losses, insurance costs and fiscal burdens.

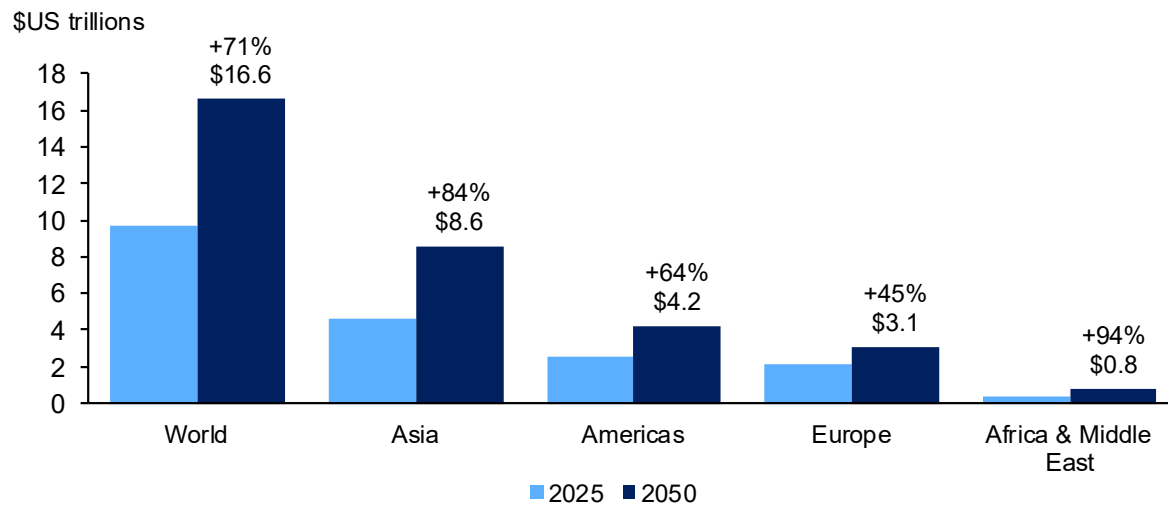
The delivery challenge is multi-faceted, covering policy, financing, industrial and labour capacity. Meeting future demand will require stronger project pipelines, more effective procurement, deeper public-private collaboration, expanded construction capacity, reliable access to essential materials and long-term capital. It will also require infrastructure to be delivered quickly and with sufficient durability and whole-of-life performance.

1.8. THE IMPACT ON GLOBAL CONSTRUCTION DEMAND

Global construction activity is expected to expand materially over the long term. Oxford Economics forecasts global construction output to reach around US\$16.6 trillion by 2050, around 70% higher than in 2025. This continues a long-running expansion in physical investment, with global construction activity almost doubling since 2002. Progressive record high levels of construction activity over the next 25 years is directly connected to the trends mentioned above. Construction demand is differentiated across regions and sectors, reflecting differences across level of economic development and existing gaps, amongst many other factors.

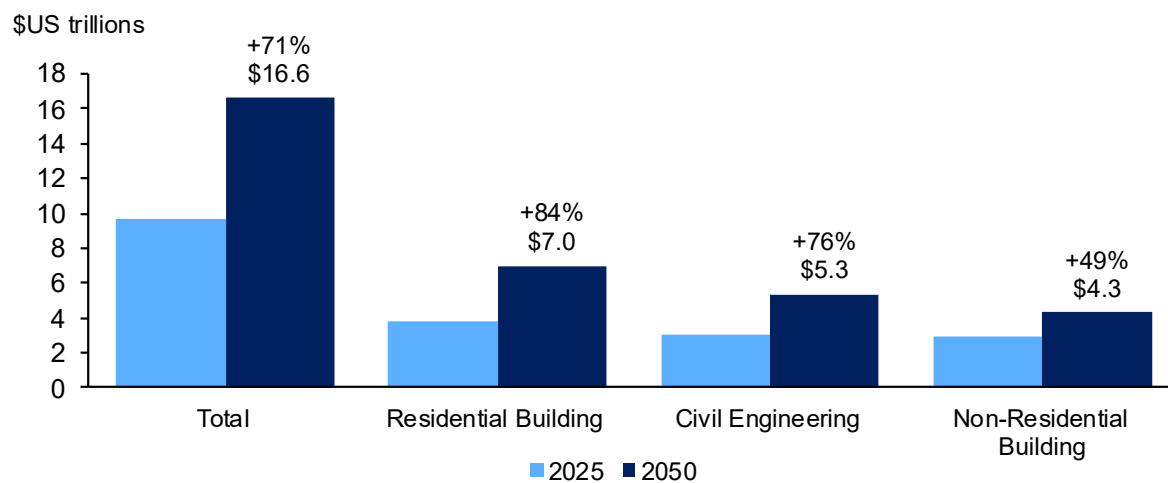
As illustrated in Figure 14, emerging and developing economies in Asia, Africa and the Middle East will face the most significant growth in construction activity – broadly linked to higher rates of urbanisation, population growth and large pre-existing infrastructure and housing deficits. Growth in the Americas and Europe is expected to be slower, with relatively low population growth and high existing urbanisation. Although emerging and developing economies – such as those in Latin America – still face significant infrastructure and housing deficits linked to uneven access.

Figure 14: Contribution to growth in global construction activity, 2025 to 2050, by region



Source: Oxford Economics

Figure 15: Contribution to growth in global construction activity, 2025 to 2050, by sector



Source: Oxford Economics

SECTION 2. THE STRATEGIC ROLE OF CEMENT & CONCRETE

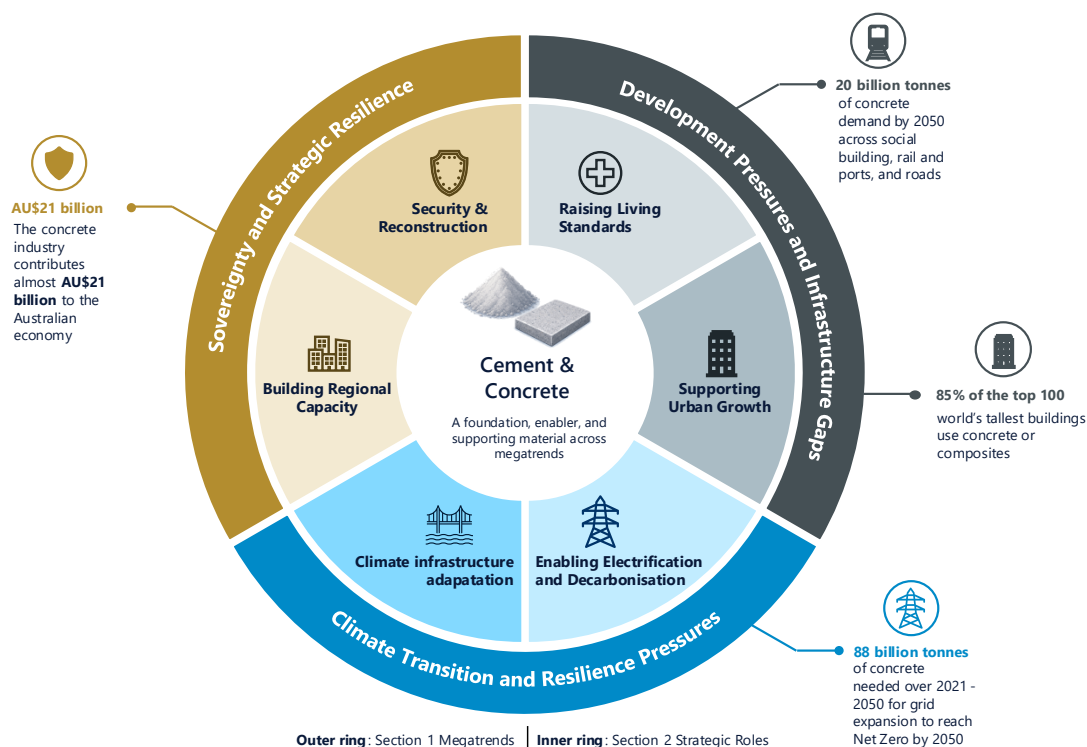
Figure 16: Strategic role for cement and concrete



The world is set to build more than ever before, with future demand increasingly shaped by higher expectations around development, resilience, decarbonisation, strategic capacity and digitalisation. This changing demand profile places cement and concrete at the centre of the delivery challenge. The following section considers how these materials support the economic, social and strategic objectives attached to future construction demand.

Cement and concrete play a central role in enabling economic development and improving living standards. Concrete underpins the infrastructure systems that drive economic and social outcomes – from housing and transport to water and energy. Figure 17 below illustrates the strategic role of cement and concrete in supporting the growth of dense urban populations, enabling climate transition and adaptation infrastructure, and strengthening sovereignty and strategic resilience.

Figure 17: Megatrends and the strategic role of cement & concrete



2.1. A PLATFORM FOR DEVELOPMENT AND LIVING STANDARDS

2.1.1. ENABLING RISING LIVING STANDARDS

Raising living standards is a fundamental policy objective as it both directly improves human welfare and also builds the economic and social foundations required for sustained growth. Improvements to income and consumption power (a common measure of living standards²⁹) have been empirically demonstrated to improve life expectancies (a relationship known as the Preston curve^{30,31}). This is further demonstrated in a comparison of life expectancies between high and low-income countries, where, as of 2024, individuals in high income countries live on average 16 years longer than those in low-income countries.

Living standards are tied to the ability to access essential services and level of economic development. Housing and infrastructure (e.g., transport, utilities) are prerequisites for economic participation. Inadequate provision can have severe consequences. In 2019, 50% of the world's population lacked adequate access to safe drinking water and sanitation, which is estimated to have contributed to over 1.4 million deaths that year.³²

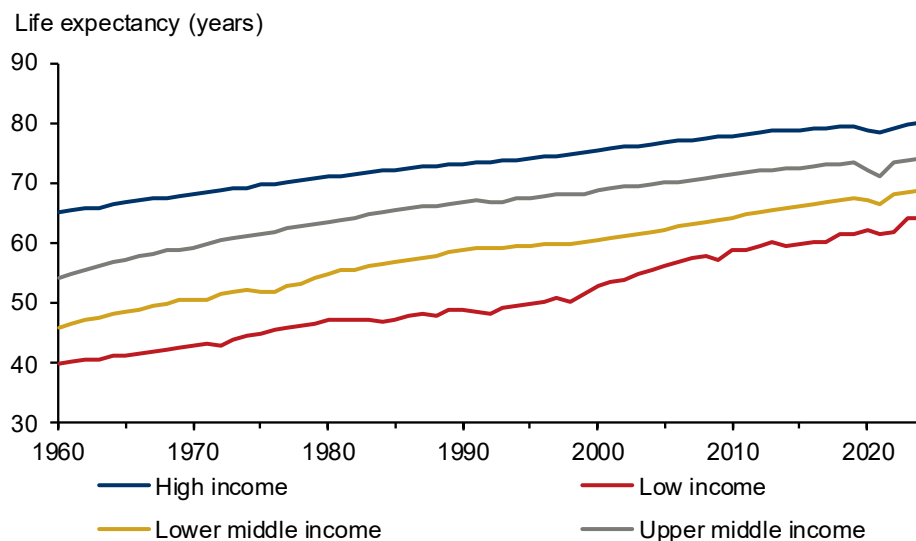
²⁹ World Bank, "Analyzing Health Equity: Measurement of Living Standards"

³⁰ Chetty et al, "The Association Between Income and Life Expectancy in the United States, 2001–2014", May 2016

³¹ Escosura, L, "Health, income, and the Preston curve: A long view", December 2022

³² World Health Organisation, "Improving access to water, sanitation and hygiene can save 1.4 million lives per year, says new WHO report", June 2023

Figure 18: Average life expectancy by income group



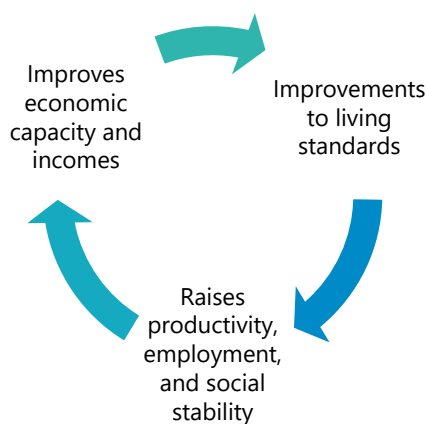
Source: World Bank

Infrastructure affects living standards through two broad channels. First, construction activity directly supports employment and income, including increased activity across upstream supply chains. Benchmark estimates suggest that US\$1 million of public infrastructure investment can generate US\$1.6 million in GDP.³³

Second, the operation of infrastructure improves social and economic outcomes – including positive impacts on productivity, mobility and service access over time. Reliable transport networks expand access to jobs and services. Electricity and digital systems support industrial activity and innovation, while water and social infrastructure improve public health and workforce capability.

These effects can reinforce one another. The adequate provision of infrastructure can support higher productivity and employment, while higher incomes and fiscal capacity can support further investment. Conversely, persistent under-provision of basic infrastructure can contribute to poorer health outcomes, weaker productivity and lower economic resilience (see Figure 19 below).

Figure 19: The virtuous cycle of economic development



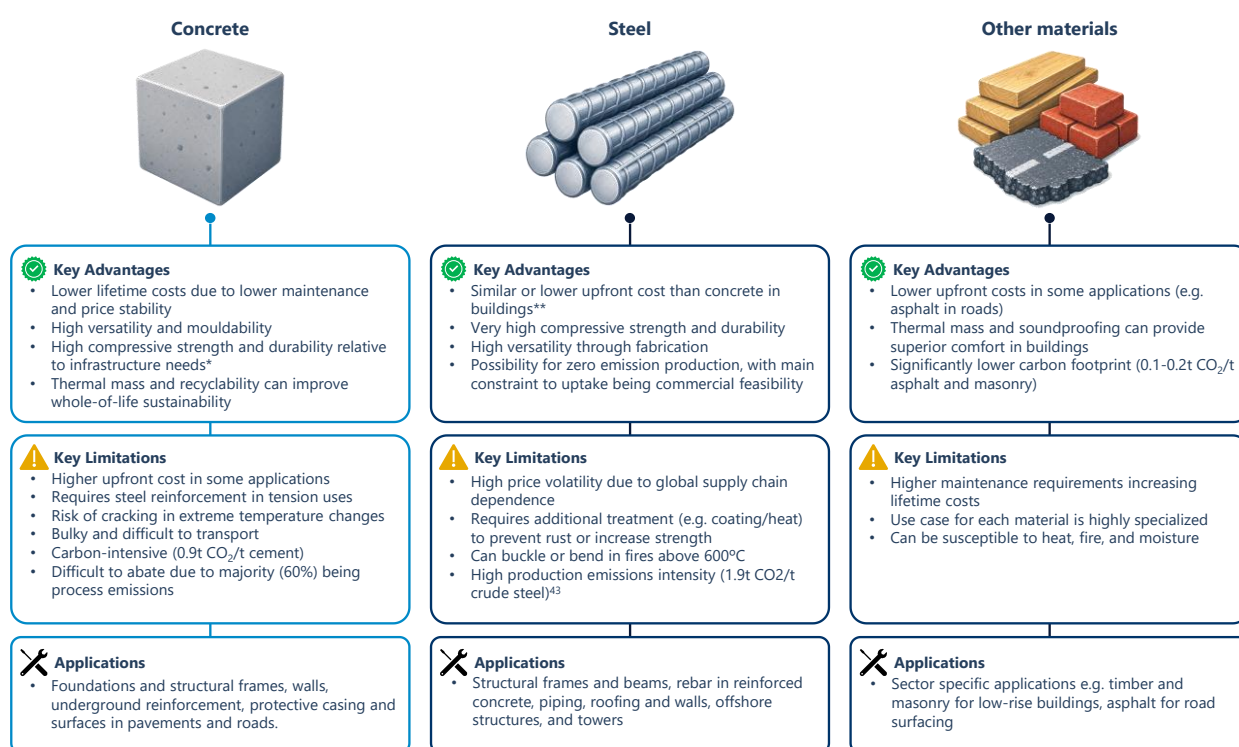
³³ Global Infrastructure Hub, "Fiscal multiplier effect of infrastructure investment", December 2020

Importantly, cement and concrete are used across many of the essential infrastructure and housing assets that support living standards. Concrete is used in infrastructure foundations, structural and load-bearing components and surfaces in pavements and roads. Its widespread use reflects its unique combination of being relatively affordable and ability to maintain structural performance in long-life infrastructure applications. This is distinct from other materials, which have attributes that make them better suited towards more specialised applications (see Figure 20).

These material attributes are directly relevant to the demand trends set out in Section 1. Population growth and urbanisation increase the need for durable housing and infrastructure. Climate change raises the value of long-life assets that can withstand more demanding conditions. Sovereign resilience and reconstruction place a premium on materials that can be supplied locally and reliably.

Infrastructure quality also materially affects the benefits communities receive. For instance, poor-quality roads and drainage increase asset failure and repair costs. Another example is provided in the case study below – regarding the “100,000 Floors to Play On” initiative in Latin America and the Caribbean.

Figure 20: Concrete performance compared to other construction materials in buildings



*Note: compressive strength measures the ability to resist squashing loads. Requirements can vary based on application, ranging from 20-50 MPa for typical building use to 50-100 MPa for heavier-duty use in high-rise buildings, and above 100 MPa for specialised ultra performance applications.³⁴ Tensile strength measures the ability to resist being pulled apart.

**A 2016 AECOM study estimated structural concrete cost approximately £3,500-4,000 per m² of gross internal floor area (GIFA) for high-rise commercial buildings. The relative cost of steel in structural frames compared to cement is mixed. Some estimates point towards it being 1-2% cheaper per m² of GIFA than buildings with cement structures, while other studies have placed steel costs for office buildings at being 4% higher.³⁵

³⁴ Eurocode Applied, “Eurocode 2 Table of concrete design properties”, Accessed April 2026

³⁵ Cromwell Property Group, “Timber buildings Cost competitive sustainable real estate”, 2023

100,000 Floors to Play On Initiative – The Health Benefits of Raising Infrastructure Quality

The 100,000 Floors to Play On initiative provides an example of how basic improvements to household infrastructure can affect health and living conditions. The programme involves replacing dirt floors with concrete floors in low-income households across Latin America and the Caribbean.

Evidence from Mexico's earlier Piso Firme programme found that replacing dirt floors with concrete was associated with a 78% decrease in parasitic infestations, a 52% decrease in adult depression and a 36%–96% improvement in cognitive development. The programme was also associated with reported reductions in medical expenses, improved household financial stability and increased investment in the home.

The case demonstrates that concrete's role in infrastructure quality is not limited to large public assets. In some low-income housing contexts, sealed and durable floors can reduce exposure to pathogens and improve the functionality of dwellings.

2.1.2. SUPPORTING URBAN GROWTH AND DENSITY

Urbanisation pressures increase demand for essential infrastructure. This requires the effective use of limited urban space, while delivering at scale and ensuring reliability. Concrete plays a central role in this task, with the ability to support infrastructure above and under-ground, and on the surface (see Figure 21).

Concrete's load-bearing capacity supports both vertical development and horizontally integrated infrastructure. Durability and fire resistance are critical given the increased consequences of asset failure. The inherent local supply chain and suitability for precast and modular production can support faster delivery and more standardised construction. Reflecting this, Oxford Economics estimates that annual concrete demand from utilities, transport and social building sectors alone will reach 20 billion tonnes by 2050 (see Figure 22).

Figure 21: Concrete's role across the different layers of complex, high-density urban centres

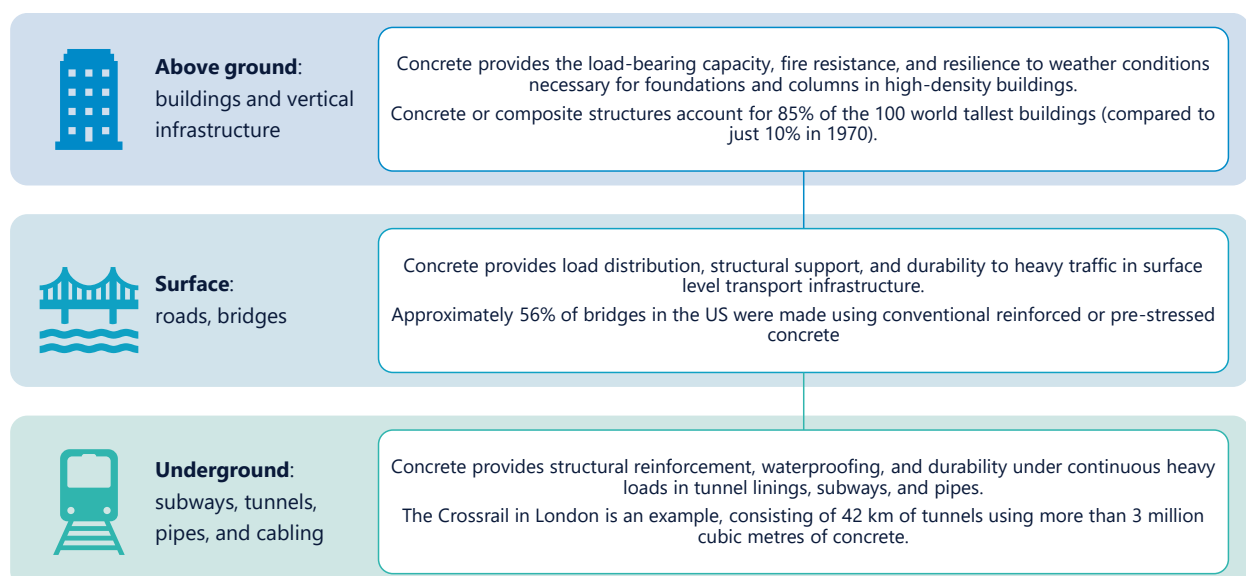
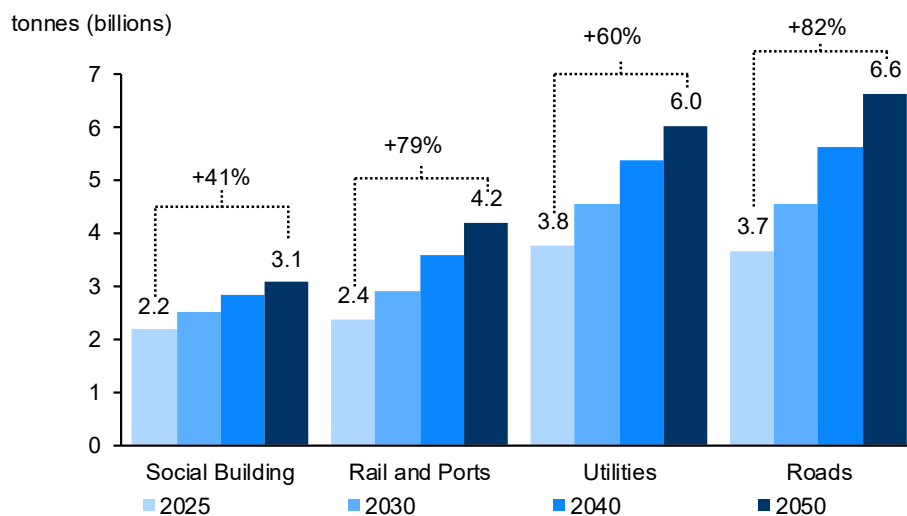


Figure 22: Annual global concrete demand from select essential infrastructure sectors (2025-2050)



Source: GCCA, Oxford Economics

India Pradhan Mantri Awas Yojana Scheme – How Concrete Enables Large-Scale Affordable Housing Delivery

The Pradhan Mantri Awas Yojana programme is focused on providing increased access to housing for low-income and vulnerable households. The scheme is one of the largest national housing programs globally, with over 9.8 million urban houses completed to date, and an addition 10 million urban houses planned for construction under the recently announced expansion. Concrete is a core material that has enabled the expansion of formal housing within the programme.

Sources: AMPP³⁶, Aurecon³⁷, Construction News³⁸

2.2. AN ENABLER OF TRANSITION AND RESILIENCE

2.2.1. ENABLING NET ZERO THROUGH ELECTRIFICATION AND DECARBONISATION

The climate transition will reshape the built environment. It requires new energy, industrial and adaptation assets, alongside upgrades to existing infrastructure exposed to rising physical risks. For cement and concrete, this creates two linked challenges: supporting the assets required for decarbonisation, while reducing emissions from cement and concrete production and use.

The assets required for decarbonisation include renewable generation, expansion and improvement of transmission and distribution networks and emerging technologies such as carbon capture, utilisation and storage infrastructure (CCUS). Concrete is used in the delivery of all of these assets, across the following applications:

³⁶ AMPP, "Highways and bridges", Accessed April 2026

³⁷ Aurecon, "Tall buildings past and present trends", Accessed April 2026

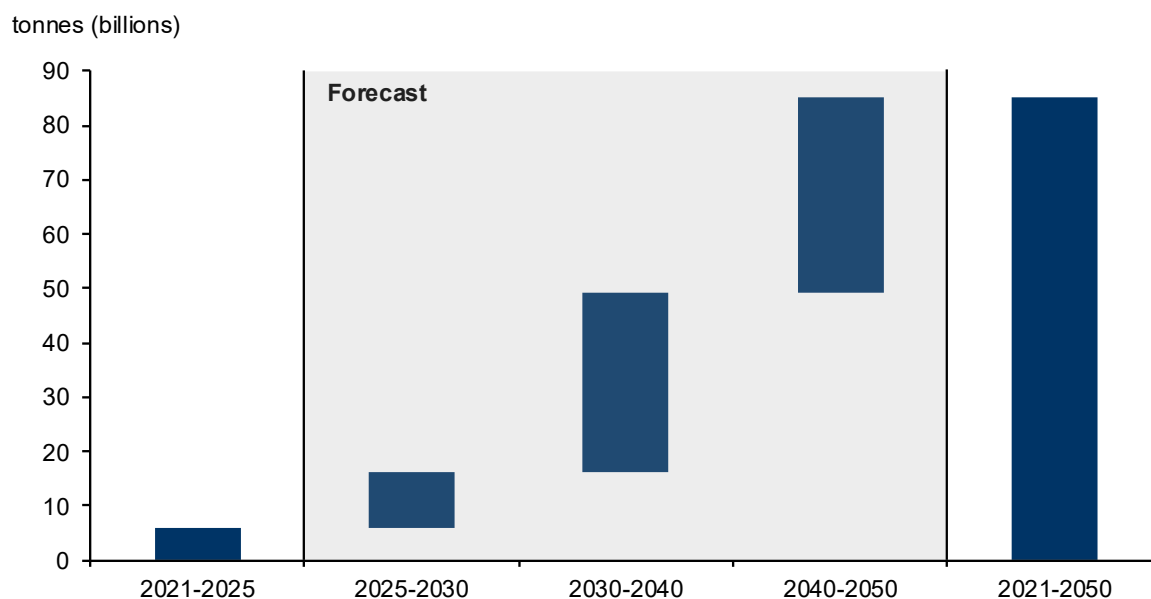
³⁸ Construction News, "How Crossrail took concrete into uncharted territory", April 2018

- **Foundations** of wind towers, solar farms and network infrastructure. There are also applications in offshore, gravity-based structures for wind that are being explored³⁹. An estimated 85 billion tonnes of concrete will be needed to support the electricity grid expansion between 2021-2050 (see Figure 23).
- **Structural walls** of hydroelectric and nuclear generation, in addition to supporting infrastructure. Concrete comprises a significant proportion of the materials used in construction, estimated at over 80% for nuclear and hydroelectric dams (see Figure 24).
- **Other applications** including protective casings for piping and cables and some grid towers.

Decarbonisation extends to objectives around lowering the emissions of transport and industrial production. Electrified transport and charging networks require supporting civil infrastructure for reliable operation, including foundations, parking and grid infrastructure.

Concrete can also support building energy performance through its thermal mass properties. In suitable designs, concrete can help reduce operating emissions by moderating internal temperatures and lowering heating/cooling demand. The Concrete Initiative estimates that thermal mass can support energy savings of around 5% for heating and 20% for cooling⁴⁰.

Figure 23: Total volume of concrete required to facilitate the grid expansion under announced pledges (2021-2050)



Note: These estimates are based on European Commission estimates of concrete intensity for overhead transmission lines and IEA's projections of grid network expansion under its Announced Pledges Scenario, which assumes all national climate targets (as of August 2024) are achieved. Calculated concrete volumes assume 100% of transmission lines and 80% of distribution lines are overhead⁴¹ and ignores underground lines, which may require varied levels of concrete protection.

Source: International Energy Agency⁴², European Union Commission⁴³

³⁹ US Department of Energy (NREL), "Materials Used in U.S. Wind Energy Technologies: Quantities and Availability for Two Future Scenarios", August 2023

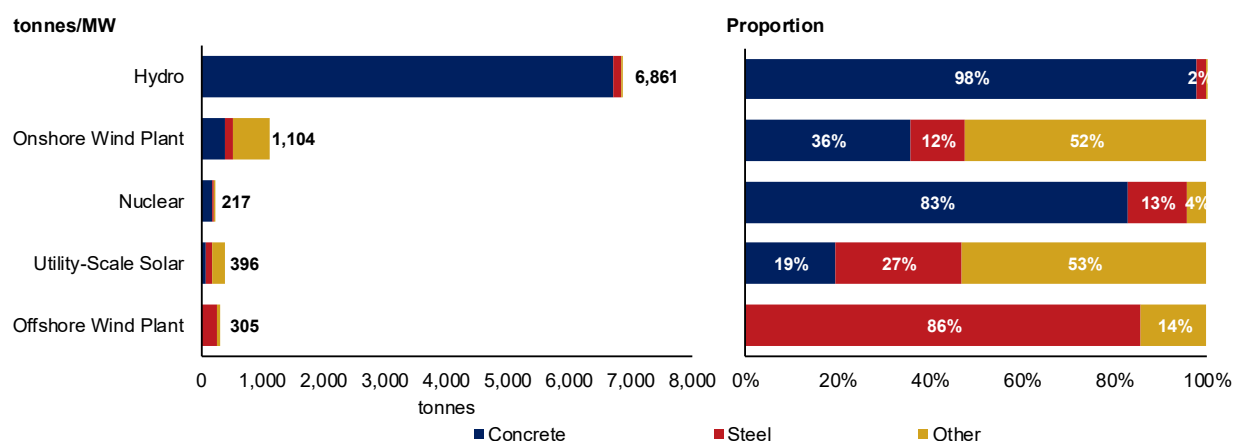
⁴⁰ The Concrete Initiative, "Thermal Mass – the smart approach to energy performance", August 2015

⁴¹ US Department of Energy, "Undergrounding Transmission and Distribution Lines", September 2024

⁴² International Energy Agency, "Electricity Grids and Secure Energy Transitions", October 2023

⁴³ European Commission, "Material requirements for electricity grids", October 2023

Figure 24: Concrete intensity per MW in renewable technology compared to other materials



Note: Nuclear intensity estimates are based on PWR nuclear reactors (the most common type available). Hydropower intensity estimates assume a capacity factor of 50% and lifespan of 100 years, and benchmarked against major dam projects

Source: US Department of Energy^{44,45}, University of California - Berkeley⁴⁶, World Nuclear Association⁴⁷

France Gamba Acoustic Building – Thermal Mass and Building Energy Performance

The Gamba Acoustic office building in France provides an example of how concrete can contribute to operational energy performance when used as part of an integrated building design. The building uses thermally active concrete floors alongside other design and technology measures, including geothermal heat pumps.

The thermally active concrete floors support passive cooling by absorbing, storing and releasing heat, reducing the need for conventional air-conditioning systems. According to The Concrete Initiative, the building achieved total energy consumption of 38 kWh/m²/year, around one-fifth of conventional building consumption.

2.2.2. A LOWER-CARBON PATHWAY FOR CEMENT AND CONCRETE

Cement and concrete face a clear emissions challenge. Cement production is emissions-intensive, while concrete's widespread use means it contributes materially to embodied carbon in the built environment. Cement and concrete can account for 25-35% of a building's total embodied carbon footprint, including emissions from manufacturing, transport and installation.⁴⁸

The future role of cement and concrete in transition-related infrastructure will therefore depend partly on reducing emissions across the value chain. This includes cement production, concrete mix design, construction practice, procurement and asset operation. This report does not seek to set out the full decarbonisation pathway for the sector; this is addressed in detail in the GCCA Concrete Future 2050 Roadmap (see below).

⁴⁴ US Department of Energy (NREL), "REMPD Wind Overview", Accessed April 2026

⁴⁵ US Department of Energy (NREL), "REMPD Solar Overview", Accessed April 2026

⁴⁶ Peterson, P. et al., "Metal and Concrete Inputs for Several Nuclear Power Plants", February 2005

⁴⁷ World Nuclear Association, "Mineral Requirements for Electricity Generation", December 2024

⁴⁸ Myint, N. et al., "Embodied carbon emissions of buildings: Taking a step towards net zero buildings", March 2024

The Path to Net Zero in the GCCA Concrete Future 2050 Roadmap

The GCCA Concrete Future 2050 Roadmap sets out a net zero pathway for the industry by 2050, identifying the seven levers needed to decarbonise across the whole lifecycle. This includes savings in clinker production (substitute with decarbonated raw materials, energy efficiency and alternate fuels in kilns), savings in cement & binders and efficiency in concrete production processes.

It also includes the usage of carbon capture, utilisation and storage technology, the decarbonisation of electricity (renewables, transmission and distribution networks) and recarbonation (a natural process of CO₂ uptake by concrete over the asset's life). Further, efficiency in design and construction is part of lowering wastage and ensuring that reduction is a design parameter.

2.2.3. CLIMATE INFRASTRUCTURE ADAPTATION

Climate change is changing the performance requirements of infrastructure. Physical climate risks are already affecting infrastructure assets and the mitigation or renewal of these effects will continue to raise required spending levels over time (as discussed in Section 1.4).

Concrete is already embedded in adaptation infrastructure because many resilience assets must perform under harsh conditions. Flood protection, water infrastructure and coastal assets are exposed to forces that can shorten asset lives and raise maintenance costs. For instance, reinforced concrete is widely used in drainage channels, flood control structures and water supply infrastructure (water treatment plants, desalination plants).

Figure 25: Concrete's role in infrastructure climate adaptation



Climate adaptation infrastructure can be exposed to hydraulic loading, erosion, extreme temperatures and mechanical stress. The durability and structural performance of concrete supports the long-term function of these assets - for example, the Eastern Scheldt storm surge barrier under the Netherlands' Delta Programme alone used 450,000 m³ of concrete (equivalent to approximately 1.08 million tonnes).⁴⁹

⁴⁹ Waternood Museum, "Eastern Scheldt Storm Surge Barrier", Accessed April 2026

Climate change will also affect infrastructure through slower changes in operating conditions. Sustained heat can shorten maintenance cycles and reduce whole-life performance. Transport systems provide a clear example. Asphalt surfaces can become more vulnerable to deformation under high temperatures, while concrete roads can provide longer maintenance intervals in appropriate applications.

2.3. A FOUNDATION FOR STRATEGIC CAPACITY

2.3.1. BUILDING ECONOMIC CAPACITY AND REGIONAL DEVELOPMENT

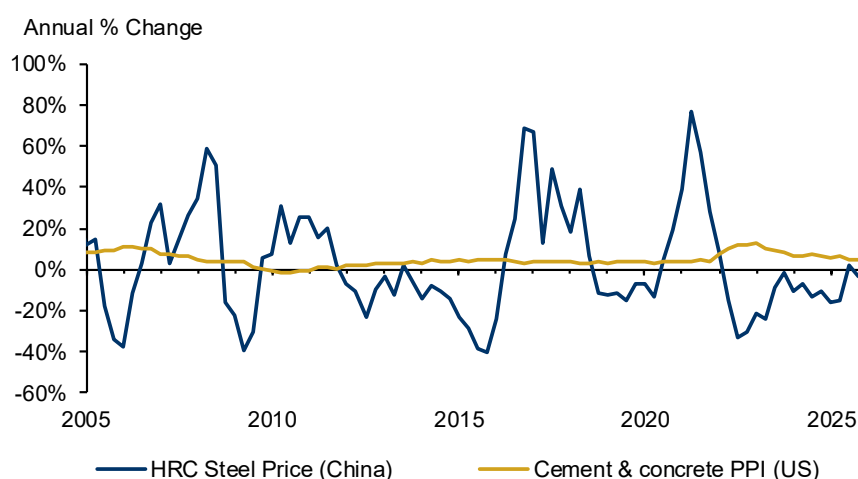
Governments are investing in domestic industrial capacity, defence readiness and reconstruction capability, creating demand for assets that often rely on cement and concrete (see Section 1.5). Strategic capability requires a large physical build-out – from resource extraction infrastructure to advanced manufacturing facilities (e.g., semiconductor plants, battery factories) in addition to traditional supporting infrastructure.

Concrete is typically produced close to end-use markets, giving the sector a role in domestic economic capacity. The high mass-to-value ratio and time-sensitive delivery characteristics make long-distance transport of ready-mix inefficient. Cement typically accounts for around 10-15% of concrete by weight, with only around 5% of cement traded internationally (which can be higher in some regions)⁵⁰.

Local production reduces exposure to global supply-chains, freight cost and currency volatility. A comparison of historical price growth between steel and concrete in the US is illustrated in Figure 26 below. It also means that cement and concrete production supports economic output, formal employment and industrial capacity in the markets where construction occurs (see case study on Australia industry below). The benefits are also regionalised, with infrastructure and housing investment supporting economic activity in surrounding areas as well as at the project site.

However, local production does not make cement and concrete immune to disruption. Energy costs, permits, aggregates availability, logistics constraints, labour shortages, land access and decarbonisation requirements can all affect local supply capacity.

Figure 26: Annual growth in steel prices compared to concrete producer price indexes (PPIs) in US, 2005-2025



Note: Maximum, minimum, and average growth rates in the RHS plot are calculated over the period between 2005-2025
Source: US Bureau of Labour Statistics, London Metal Exchange, Oxford Economics

⁵⁰ GCCA, "Local availability", Accessed May 2026

The Economic Contribution of the Cement Concrete and Aggregates Industry in Australia

The Australian cement, concrete and aggregates industry provides an example of the regional economic role of construction-material supply chains. In FY25, the industry was estimated to have contributed almost AU\$21 billion to the Australian economy and generated almost AU\$17 billion in annual revenue.

The sector supports activity across Australia's AU\$175 billion construction sector and public infrastructure pipeline. Employment is distributed across cement manufacturing, concrete production, aggregates, transport and related supply chains. The industry directly employs nearly 22,000 workers, with a further 7,500 truck drivers involved in transporting cement, concrete and aggregates.

The case illustrates the localised nature of the sector's economic footprint. Cement plants, quarries, batching facilities, transport operators and related suppliers are typically embedded in regional construction markets. This makes the industry relevant not only to material supply, but also to local employment, delivery capacity and infrastructure-sector resilience.

Source: CCAA, Oxford Economics Australia

2.3.2. SECURITY AND RECONSTRUCTION

Higher defence spending and greater focus on civil preparedness are increasing demand for infrastructure that supports military readiness. Defence capability depends on the condition and availability of physical assets, not only equipment. Bases, airfields, ports and logistics facilities require ongoing construction, maintenance and renewal. Concrete is widely used in these settings because defence assets often need high load-bearing capacity, durability, fire resistance, weather resistance and protective performance.

Concrete also has a role in the safe storage of explosive and hazardous materials, particularly when military facilities are located near industrial areas or urban development. This is a growing concern in some regions, for example in South Korea, where rapid urbanisation has resulted in military facilities being located near dense residential areas.⁵¹ Research supports the usefulness of concrete, with a 2024 study testing the performance of partially buried reinforced concrete structures under a 5.9 kg TNT explosion. The high-strength concrete structures suffered only mild damage.⁵²

Reconstruction is another dimension of strategic capacity. Conflict and natural disasters can devastate the infrastructure base, leaving governments to restore housing, transport and basic services while disruption may still be ongoing. Ukraine illustrates the scale of this challenge, discussed further in the case study below.

⁵¹ Choi, M, "Direction of military environment and construction project", 2009

⁵² Park, Y. et al., "Experimental Evaluation on Blast Resistance of Reinforced Concrete Structures under Partially Confined Explosion", June 2024

Ukraine Conflict Damage and Reconstruction Requirements

The latest joint assessment by the World Bank, Government of Ukraine, European Commission and United Nations have estimated reconstruction and recovery needs in Ukraine of almost US\$588 billion over the next decade. Transport infrastructure alone accounts for more than US\$96 billion of that need.

Concrete and cement-based materials are central to this kind of recovery because they are used in the permanent assets that must be rebuilt or repaired. They also create opportunities to reuse damaged material. In Ukraine, UNDP has supported the clearance of one million tonnes of debris, with sorted material already being used in applications such as road and footpath surfacing.

SECTION 3. STRATEGIC CONSIDERATIONS

The analysis in this report points to a central conclusion: the coming decades will be defined by rising physical demand. Population growth, urbanisation, housing deficits, ageing infrastructure, climate adaptation, the energy transition, digitalisation and strategic resilience will all require sustained investment in the built environment. These pressures are not uniform across countries or asset classes.

For policymakers, investors and industry leaders, the question is how that next generation of infrastructure can be delivered affordably and reliably while supporting climate goals. Cement and concrete sit at the centre of this challenge because they are embedded across the infrastructure systems that support modern economies: from housing and transport networks to water, energy and industrial assets.

Ultimately, in meeting growing physical demand for built infrastructure, the cement and concrete industry will need to meet both resilience *and* sustainability goals. The implications of this – not just for the cement and concrete industry, but for broader infrastructure stakeholders and policymakers – include:

- **Acknowledging and credibly measuring the positive social and economic impacts of the cement and concrete industry**, particularly for local and regional communities.
- **Understanding how megatrends are changing built asset provision**: where assets are being built, the types of assets being built and how they are being delivered.
- **Harnessing innovation in concrete design, manufacture and construction industry application** so concrete supply can stretch to meet rising demand and sustainability goals.
- **Recognising that resilience needs to be considered alongside sustainability and decarbonisation objectives**, including the role the cement and concrete industry can play in strengthening sovereign strategic resilience as well as the durability and resilience of built assets.
- **Factoring resilience properly into insurance risk frameworks and infrastructure business cases** to ensure effective provision of high-quality infrastructure and housing to meet changing environmental and economic conditions.
- **Building the necessary data infrastructure and regular reporting** that underpins the evidence base for resilient and sustainable infrastructure provision.
- **Ensuring the cement and concrete industry manages rising costs** in meeting resilience and sustainability objectives and remains able to respond effectively to demand.

Consequently, it is critical that the cement and concrete industry is positioned as part of the solution to a more demanding global infrastructure challenge: enabling development, supporting resilience, strengthening communities, reducing emissions and maintaining the physical systems on which economies depend.

3.1. GLOBAL DEMAND DRIVERS, LOCAL IMPACT

This report details the global megatrends which are driving rising physical demand. But, for the cement and concrete industry, the positive social and economic impacts are much more local. Unlike many globally traded construction inputs, concrete is typically produced and used within relatively short distances of the point of

application, reflecting both its physical properties and transport economics. This characteristic has important implications that extend well beyond construction efficiency. In meeting rising physical demand, the cement and concrete industry will continue to play a vital role in supporting growth in regional and local jobs, incomes and living standards.

Cement plants, quarries, batching facilities, transport networks and on-site construction activities are embedded within local economies, creating jobs across a broad value chain that includes extraction, processing, logistics, engineering and construction services. This local footprint means that infrastructure investment has geographically distributed economic benefits.

Local supply has strategic implications for delivery capacity. The increasing urgency of infrastructure demand increases the value of the sector's ability to mobilise materials and labour at a local level. Materials that rely heavily on long-distance supply chains may be more exposed to disruption, cost volatility and delays.

For policymakers and stakeholders, this highlights that the cement and concrete sector is part of a broader system of local economic capacity. The resilience of this system – its workforce, supply chains, regulatory environment and investment conditions – will influence how effectively infrastructure can be delivered and how widely its economic benefits are shared across communities.

3.2. MEETING DEMAND IN NEW REGIONS AND FOR NEW ASSETS

Construction demand will not follow a single global pattern and will be shaped by divergent regional and economic needs.

Emerging and developing economies face severe pre-existing infrastructure and housing deficits, while also needing to cater to the needs of a larger and increasingly urban population. For advanced economies, the priority shifts more towards asset repair and modernisation. These economies have significant legacy asset bases and regeneration requirements, while also needing to address housing shortages and climate adaptation.

These demand profiles create different requirements for cement and concrete markets. Fast-growing cities need dependable supply chains and construction methods that can deliver large volumes at reasonable cost. Legacy infrastructure needs materials that are suited to repair, rehabilitation and long-life performance. Climate-exposed regions will need infrastructure that can withstand heat, flood, fire, salinity and water stress. Digital and industrial hubs will need high-specification facilities supported by reliable energy, water and transport networks.

The strategic opportunity for the sector lies in understanding at a more granular level: where demand is emerging, which asset classes are driving it, what performance requirements those assets will require and how best to "meet the moment".

3.3. HARNESSING INNOVATION AND PRODUCTIVITY

The sheer scale of growth in demand for built assets presents a core challenge for the concrete industry. Increasing supply to match demand, region by region, can take a long time to materialise and have considerable investment costs. Supplies of key inputs such as quarry materials can be scarce in many regions or take many years to come online.

A key solution for the concrete industry in meeting demand and sustainability objectives is harnessing innovations to improve *productivity*. This includes innovation in both concrete design and manufacture, as well as supporting initiatives to increase productivity outcomes across the construction industry more broadly.

Improving the efficiency of concrete design and manufacture can play a key role.

Advances in high-performance concrete and performance-based specifications can help achieve the same or better structural outcomes using less material. Meanwhile, increasing use of supplementary cementitious materials can reduce dependence on clinker, which remains both emissions-intensive and increasingly constrained in some regions. Digital technologies, including AI-enabled mix optimisation, automated batching systems and real-time process monitoring, can also help producers improve consistency, minimise overdesign and increase plant productivity.

Industrialisation and circular economy approaches are also expected to become increasingly important.

Greater adoption of precast and modular construction systems can significantly reduce material waste and improve quality control. Recovery and recycling, alongside broader use of industrial by-products, can help reduce reliance on virgin raw materials while supporting lower-carbon production pathways. Emerging technologies such as carbon mineralisation and CO₂ curing may further improve material efficiency while creating opportunities for permanent carbon storage within concrete products.

Broader innovation across the construction sector will be essential to reducing unnecessary material demand.

Unfortunately, the construction industry has a relatively poor productivity track record historically compared to other industries⁵³ and is also considered to benefit less than other industries from the current AI driven "productivity boom".⁵⁴ The construction industry's poor productivity performance is due to its relatively fragmented and project-based nature, reliance on labour-intensive onsite processes, limited standardisation, and historically low levels of digitisation and automation.

Construction projects typically involve numerous subcontractors and bespoke designs delivered in complex and variable site conditions, which can lead to coordination challenges and inefficiencies. Traditional procurement models have also often prioritised short-term cost minimisation over long-term productivity and innovation and tend to use highly prescriptive rather than performance or outcome-based specifications in contracts. Meanwhile skills shortages and underinvestment in technology have further constrained productivity improvements across the sector.

The challenge for the concrete industry is not just about producing more concrete. Rather, it is increasingly about delivering more infrastructure, housing and economic value per tonne of material, per unit of carbon, per worker and per unit of energy. Innovation therefore becomes not only a decarbonisation pathway, but also a productivity and resilience strategy for the global concrete industry.

⁵³ Goolsby, A. and C. Syverson (2023) "The Strange and Awful Path of Productivity in the U.S. Construction Sector", Becker Friedman Institute, BFI Working Paper No 2023-04, the University of Chicago

⁵⁴ Liam, S. (2026) "AI will deepen regional inequality", Global Research Briefing, Oxford Economics, April 28.

3.4. STRENGTHENING SOVEREIGN STRATEGIC RESILIENCE

Recent events have increased the value of maintaining or strengthening existing domestic industrial capacity and capability.

Historically, advanced economies have 'outsourced' many areas of manufacturing to lower cost countries on cost and efficiency grounds. The resultant 'hollowing out' of skills and expertise has increased the exposure of these economies to global supply chain risks. Sovereign nations have become less resilient to rising threats caused by emerging geopolitical fragmentation and tensions. This includes increasing threats to free and open trade, growing defence imperatives and mounting reconstruction needs.

In recognition of this, infrastructure - and the supply chains which support its delivery - are moving back into the centre of national economic strategies that focus on both efficiency *and* resilience. Transport, energy and water infrastructure, industrial facilities and secure digital networks are increasingly part of how nations think about economic security and strategic autonomy.

Locally available construction materials such as cement and concrete have an important role to play in supporting and re-strengthening sovereign resilience and capability.

Concrete's regional production model can support infrastructure delivery even when international supply chains are disrupted. It can also support reconstruction after conflict or disaster – particularly when speed and scale are critical. This is not an argument for self-sufficiency, but rather about deepening the ability to maintain delivery under stress. This requires diversified supply chains, local production capacity, skilled workforces and resilient logistics.

3.5. ENSURING FINANCIAL VIABILITY AND SUPPLY TO MEET DEMAND

The economic and cost pressures which drive underinvestment in domestic capacity and capability have not eased. If anything, cost pressures on the cement and concrete industry have become more intense.

Rising energy, raw materials, labour and logistics input costs are placing upward pressure on production costs across the sector. Higher financing costs and delivery constraints are also limiting the ability of industry to respond to demand. These constraints include slow approvals, limited procurement capability, labour shortages, connection delays and land access issues.

These pressures are being compounded by the additional investment required to transition toward lower-carbon production processes. Decarbonisation pathways for cement and concrete require significant capital expenditure and increased operational expenditure, including processes such as clinker substitution, alternative fuels, energy efficiency improvements and carbon capture technologies.

Maintaining affordability while enabling decarbonisation is therefore a structural tension.

On one hand, there is a growing need for large-scale and affordable infrastructure to support economic, social and environmental goals. On the other, the cost base of producing key construction materials is rising, both from traditional inputs and from the transition to lower-carbon production.

The implications extend beyond the industry itself. If rising costs undermine the financial viability of cement and concrete production, this could constrain supply, delay projects, or increase the cost of infrastructure delivery more broadly. Given the central role of concrete in housing and infrastructure, such pressures could

have wider economic and social consequences. This includes worsening housing affordability, infrastructure provision and investment feasibility.

This reinforces the importance of considering financial viability alongside sustainability objectives. The transition to lower-carbon cement and concrete will need to occur in a way that preserves the industry's ability to deliver materials at scale and reasonable cost to meet growing demand. This may place greater emphasis on policy frameworks, procurement approaches and financing models that recognise both the cost of transition and the value of maintaining a resilient, investable industrial base.

3.6. CONSIDERING RESILIENCE AND DECARBONISATION TOGETHER

The built environment faces a dual climate challenge, where it must reduce emissions while also becoming more resilient to physical climate risks that are already increasing.

These objectives are highly interrelated. Infrastructure that is low-carbon but not durable may fail to deliver long-term sustainability. Infrastructure that is resilient but highly carbon-intensive may become harder to finance, approve or insure.

This creates both pressure and opportunity for the sector. Cement and concrete must continue reducing emissions from production, while also demonstrating how concrete can contribute to long-life, resilient infrastructure. This points to a broader focus on whole-life performance, covering embodied carbon, operational efficiency, durability, maintenance requirements and end-of-life circularity. These benefits should be considered alongside, rather than as a substitute for, continued emissions reduction across cement and concrete production.

Climate risk is becoming increasingly material to this equation. Rising disaster losses and higher insurance premiums can increase the cost of capital and reduce investment appetite. This places resilient infrastructure as an increasing economic and financial priority. Better adaptation assets and more resilient urban systems can help reduce losses and support insurability over time.

For the cement and concrete sector, this means that resilience is likely to become a stronger part of the investment case. The ability to demonstrate performance under changing climate conditions will increasingly matter to governments, insurers, infrastructure owners and financiers.

Public procurement is particularly relevant. Narrow assessment criteria, whether focused on lowest upfront cost or emissions per unit of material, can under-value whole-life asset performance. A more mature approach would assess infrastructure over its lifecycle, recognising the interaction between carbon, cost, durability and maintenance.

Resilience, infrastructure expansion and decarbonisation objectives are unlikely to progress in parallel.

The immediate priority remains closing substantial infrastructure and housing gaps, particularly for emerging and developing economies. While decarbonisation remains an important long-term objective, the pace and sequencing of transition pathways may differ materially from those observed in advanced economies with more mature infrastructure stocks and greater financial capacity.

This highlights the importance of "transition sequencing", recognising that infrastructure expansion and economic development may need to precede the full deployment of higher-cost decarbonisation pathways.

The practical implication is that decarbonisation pathways reflect differing national circumstances, institutional capacities and stages of development.

For instance, emerging economies may have early-stage priorities focused on improving material efficiency, expanding the use of lower-carbon cementitious materials, improving construction productivity and building resilient long-life infrastructure. A sequenced transition may therefore allow countries to continue addressing critical development needs while progressively reducing the emissions intensity of construction and infrastructure systems over time.

Recognising these trade-offs has important implications for policymakers and industry. Global transition frameworks may need to allow greater flexibility in the pace and composition of decarbonisation pathways across regions, while placing stronger emphasis on technology transfer, concessional finance, industrial capability building and infrastructure investment in low income economies.

The scale of required investment in housing and infrastructure is too large to be financed by public budgets alone.

Large pools of private capital are available, and allocations to infrastructure are increasing as investors seek long-duration assets with stable returns. The constraint is bankability. Projects need credible risk allocation, predictable revenues and clear pipelines before capital can translate into delivered assets.

Public finance will remain essential where social returns are high and user revenues are limited. Private participation will depend on structures that make risk and revenue more predictable. Guarantees, concessional finance and blended finance can reduce risk for investors. Availability payments, regulated asset models and long-term offtake agreements can provide more stable revenue streams. Well-designed structures can mobilise additional capital while limiting affordability pressures and contingent liabilities.

3.7. CREDIBILITY WILL BE DEFINED BY DATA, STANDARDS, AND EVIDENCE

Arguments supporting the role of cement and concrete will be strongest if they remain evidence-based and balanced. Cement and concrete are essential to the built environment, but the sector also faces legitimate scrutiny because of its emissions profile. Credibility depends on acknowledging concrete's role in enabling development, resilience and strategic capacity whilst also achieving targets for lower-carbon production and better whole-of-life performance.

This places a high premium on standards, data and transparent performance measurement. Governments and clients will increasingly require quantitative evidence on metrics such as embodied carbon, durability, recycled content and lifecycle cost. Industry will need to consistently demonstrate progress through comparable metrics and credible case studies rather than broad claims. This will in turn necessitate more rigorous and regular industry data collection, analysis and reporting which reinforces the social and economic benefits of the industry and evidence that it is meeting agreed goals and targets.

The opportunity is significant. If the sector can combine scale, affordability and local availability with lower-emissions production and verified performance, it will continue to remain central to the next generation of infrastructure investment.

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