

BOOK

Property and Construction Handbook International Edition 2014



FOREWORD

The world is looking towards a new era of growth, and a new economic and political context in which to deliver it.

This follows the economic turmoil of recent years — of a scale not seen since the1930s. As global business and construction trends rebound, our industry needs to take an active role in how this new era will be formed. Enhancing productivity is now of paramount importance to realizing sustainable economic growth.

As an industry we are faced with challenges such as shifting demographics, limited public funding, tightening of credit terms and a lack of sufficient investment in infrastructure. However, we also see great opportunities in integrating new technologies, applying advanced materials, leveraging alternative financing, and rapidly sharing knowledge and resources across an increasingly globalized world.

While some of these factors we have faced before as part of the cyclical nature of our industry, many we have not. Structural changes are reshaping our national economies and this requires a new way of thinking. In this regard, we felt it was the ideal time to release the first international edition of our annual industry handbook. This Blue Book draws upon knowledge and experience from our leading thinkers across the globe as we explore some of the big ideas needed to improve productivity.

I hope you find the 2014 Blue Book insightful and as always we welcome your views on shaping the future of our industry.

frim Fire



Jason Prior Global chief executive, buildings + places

PRODUCTIVITY INSIGHTS

14

20

26

32

38

BUILDING RESILIENT PLACES

- 9 A COMMUNITY-LEVEL VIEW
- 11 EVERY LAST DROP COUNTS
- 12 BUILDING EFFICIENCY THROUGH RESILIENCE

ENHANCING THE USER EXPERIENCE

- 15 CREATING LOYALTY
- 17 SUSTAINING THE EXCITEMENT
- 18 ENABLING TRANSFORMATION

INNOVATIVE CONSTRUCTION

- 21 TIMBER GAINS GROUND
- 23 NANOTECHNOLOGY: SMALL WORLD, BIG IMPACT
- 24 NAVIGATING COMPLEXITY IN CONSTRUCTION

RESTRUCTURING LABOR

- 27 IMPACT OF PREFABRICATION MANDATES
- 28 TRADE LABOR FORCE ENTITLEMENTS
- 30 EFFECTIVE 24-HOUR WORK CYCLES

TECHNOLOGY TRANSFORMING INDUSTRY

- 33 INTEGRATED BIM AND GIS
- 35 CASE STUDY: KING KHALID MEDICAL CITY
- 36 STRATEGIC LIFECYCLE ASSET MANAGEMENT

ALTERNATIVE FINANCING

- 39 VALUE CAPTURE FOR URBAN RENEWAL
- 40 PUBLIC-PRIVATE PARTNERSHIPS
- 41 AECOM CAPITAL
- 42 ALTERNATIVE FINANCING FOR EXISTING BUILDINGS
- 43 COLLABORATIVE DELIVERY

MARKET TRENDS + COST BENCHMARKS

46

56

GLOBAL CONSTRUCTION COSTS

- 46 GLOBAL TRENDS
- 47 RESIDENTIAL
- 48 COMMERCIAL
- 49 OFFICE LEASING RATES
- 50 TOURISM
- 51 INDUSTRIAL
- 52 GLOBAL UNITE

REGIONAL CONSTRUCTION COSTS

- 56 AFRICA
 - 64 ASIA
 - 72 AUSTRALASIA
 - 80 EUROPE
 - 88 MIDDLE EAST
- 96 NORTH AMERICA

BY REGION: Market trends Relative cost of construction Sector rates Major unit rates Cost indices

104

CLOSING REMARKS + AECOM CONTACTS

105 CLOSING REMARKS ON PRODUCTIVITY106 AECOM CONTACTS

PRODUCTIVITY INSIGHTS

- 08 BUILDING RESILIENT PLACES
- 14 ENHANCING THE USER EXPERIENCE
- 20 INNOVATIVE CONSTRUCTION
- 26 RESTRUCTURING LABOR
- 32 TECHNOLOGY TRANSFORMING INDUSTRY
- 38 ALTERNATIVE FINANCING

BIG IDEAS UNLOCKING PRODUCTIVITY GAINS ACROSS

As the global economy recovers, organizations are operating in an altered landscape and looking to a new era of growth.

While the state of markets around the world varies, all are seeing structural shifts that go beyond cyclical adjustments. These disruptive trends are having a profound effect on productivity in the built environment.

Governments are under pressure, the role of the private sector is expanding and new forms of community engagement are emerging. Businesses are responding to increased flows of people and finance; new industries, technologies and capabilities; as well as demographic challenges and the growing significance of the function of our cities. These shifts are part of a new landscape, and are driving demand for greater efficiencies in labor, capital and resources.

The way we use our buildings and spaces is changing. This focus has changed the way we work in the property and construction industry, how our efforts shape the buildings and landscapes we help create. An integrated view is required to achieve the most productive outcomes.

In this section we examine how the industry is driving change across the design, build, finance and operate stages of a project.







BUILD

BUILDING RESILIENT PLACES

An integrated approach to planning cities

Businesses and government working together to transform neighborhoods

ENHANCING THE USER EXPERIENCE

Looking beyond traditional user engagement to boost performance of buildings

Enhancing the user experience to unlock new revenue

INNOVATIVE CONSTRUCTION

Advanced manufacturing improving financial and environmental benefits

New industries bringing design smarts to the fore

Innovation enabling previously unimagined ambitious projects

RESTRUCTURING LABOR

Construction following other industries on improving productivity

Labor shifting to higher productivity tasks

Efficiency gains stemming from global flows of work

TECHNOLOGY TRANSFORMING INDUSTRY

\$\$\$

FINANCE + OPERATE

> Data capture transforming the delivery and operation of buildings and infrastructure

Rethinking cultural and industry behavior to capitalize on technology integration

Evidence-based decision making replacing intuition

ALTERNATIVE FINANCING

New financial mechanisms needed to build and sustain our cities' infrastructure

Private sector partnerships funding the shortfall in public sector funds

Collaborative procurement models delivering better value

BUILDING RESILIENT PLACES

- TNI /

River of Life Kuala Lumpur, Malaysia

38

Building healthy, prosperous communities requires an approach that understands the complexity of our cities.

It requires integrated-thinking across buildings and neighborhoods, stages of development and systems that make up our city — be they transport, utilities, business or social networks.

A community-level view

Creating more productive places and communities involves thinking about how our buildings, infrastructure and natural resources can work together. It is also important to adopt this approach from the very early planning stages of inception or renewal.

Planning tools that take a broad view of this urban fabric, such as AECOM's Sustainable Systems Integration Model (SSIM[™]), help urban developers and planners to make better informed decisions. By combining a series of sustainability systems with the insights of leading practitioners, SSIM[™] helps support a project to achieve both its value and performance goals. It gives an indication of cost benefits across areas such as building energy, water systems, transportation, ecology, renewable energy and socio-economics. SSIM™ incorporates Geographic Information Systems (GIS) based spatial analysis; databases to draw on regional factors such as climate or cost; international case studies and benchmarks; and a dashboard interface for adjusting options in real-time.

SSIM[™] for master planning helps find the best path for precinct planning, by considering these key questions:

- Which plan is the 'better' plan in terms of satisfying a city's major goals?
- Which plan is inherently more sustainable and resilient?
- Where are the planning gaps and how/ where can we improve the plan?
- How do we effectively communicate the complexity of urban planning decisions to a broad range of stakeholders?
- How do we measure the performance and costs of sustainability, as well as demonstrate positive returns?



SSIM[™] supports better decision-making

In many rapidly developing parts of the world, bold cities of the future are being created by taking a visionary approach. In north-western China, AECOM and Samsung are using SSIM™ to help realize the ambitious goals of Samsung's Xi'an city.

Since appearing in China's 12th Five-Year Plan, the "smart city" has become a policy-driven pursuit for many Chinese cities. With Samsung's US\$7 billion investment in Xi'an's Hi-tech Industrial Development Zone for its semiconductor plant, the 478-hectare adjacent land provided an ideal opportunity to create Xi'an Smart City.

Rather than approach "smart" from the usual angle of technology-driven marketing that is often focused on a single system or industry, the Xi'an Smart City concept will be focused on sustainability and integrated systems. It will address broader urban goals, such as liveable, healthy, garden cities that are low carbon and high performance. Samsung Eco-Smart City, powered by SSIM™, creates the vision which can then be evaluated and monitored.



Xi'an aims to attract large-scale foreign investment, while also encouraging young local entrepreneurs in business incubators. This represents a modern day evolution of Xi'an's history as the starting point of the Silk Road, bridging cultures from the East and the West.

Managing the complexity of established communities to achieve greater efficiencies requires going beyond design considerations. It is also imperative to have the right governance models to engage existing stakeholders.



SSIM[™] dashboard tool

For example, in Sydney, Australia, the Cooperative Research Centre for Low Carbon Living, in conjunction with project partners AECOM, Brookfield Multiplex (Flow Systems), City of Sydney, Sydney TAFE and the University of Technology Sydney, is considering the demand and supply relationships for the electricity and water grids in the city's Broadway precinct. It will determine how to effectively collaborate at a precinct scale by building a business case that considers the economic and environmental efficiencies of scale to be achieved through working together.

Every last drop counts

Elsewhere, this integrated, whole-ofsystems approach is enabling greater water efficiencies. Many of these efforts also provide further benefits such as waste management; the production of clean energy; food; or the preservation of our natural environment.

For example Singapore's national water agency, PUB, has been helping the country advance towards water independence by creating drinking water from captured stormwater and recycled wastewater. These major investments in new forms of water infrastructure. such as the Deep Tunnel Sewerage System (Stage 2), are also improving energy security by maximizing energy recovery, as well as freeing up land for more productive uses. In South Africa, water as well as various forms of waste are being used more efficiently through the Strumosa Urban Agriculture and Waste Drop-off Centre. The Centre focuses on educating locals and supports the development of local businesses.

Cities are also recognizing that our ecological infrastructure is just as critical as our engineered infrastructure by implementing the principles of Water Sensitive Urban Design (WSUD) or Sustainable Drainage Systems (SuDS). Rain gardens, bio-retention tree pits, green roofs, permeable paving and open channels and ponds as alternatives or enhancements to piped drainage systems bring multiple benefits. As well as efficiently managing flood risk and water resources, they also improve biodiversity, reduce the urban heat island effect, and improve liveability.

These lessons are being applied in many different parts of the world. In the U.K., the Greenstreets@Counters Creek initiative, funded by Thames Water, is looking at retrofitting London neighborhoods with SuDS to manage urban flooding. In the Philippines, an Ayala Land retail center is using WSUD to improve water quality. Stormwater will be filtered through the space before flowing into the nearby Pasig River.

Vater collection distribution) Green Roofs at lower, less levels Distributed ind treatment Center Rooftop water catchment (Blue Roofs) Cenal edge (retradation treatment Cenal edge of peak town treatment Cenal edge of peak town town Cenal edge of town Cen

WSUD features, Ayala Land, Philippines

"WATER NEEDS TO BE TREATED AS A PRECIOUS RESOURCE AND REQUIRES A MORE HOLISTIC APPROACH TO MANAGING SUPPLY AND QUALITY." Matthew Jones, district lead, North of England water consulting, AECOM

Building efficiency through resilience

The United Nation's R!SE¹ initiative is another tool that can improve a city's efficiency in terms of resilience to shocks, disasters and climate impacts. Following more than a decade of record-breaking economic losses and disruption, R!SE aims to bring disaster risk management to mainstream corporate planning and investment decision-making.

R!SE enables cities to identify vulnerabilities in the population, infrastructure, economy and environment. It will target investment, track progress, and help monitor citizens' awareness. It will model the impact of land use or infrastructure decisions on future resilience, and help explain these decisions to local communities.



AECOM will lead the R!SE stream that facilitates public-private sector engagement on resilient cities, building on previous collaborations in the form of a city Resiliency Scorecard jointly developed by IBM and AECOM. Understanding the complexity of a city's 'system of systems' requires integrated thinking. Multiple owners and stakeholders need to be involved in order to protect our natural assets and ensure business continuity.



The economic and human impact of disasters in the last 12 years

"RESILIENCE REQUIRES PUBLIC-PRIVATE ENGAGEMENT TO ADDRESS THE 'SYSTEM OF SYSTEMS' THAT MAKE UP A CITY." Michael Nolan, global leader, climate adaptation, AECOM

More collaboration between cities and business will help both parties fully identify and manage risks from climate change. The latest report from CDP² found that 31 percent of the risks reported by businesses are not currently recognized by the cities involved. By working together businesses and the government sector can better identify the potential impacts of climate change on the broader economy and the health and wealth of its citizens.

This includes investment planning for new projects, but also dealing with existing structures, systems and constraints. Moreover, it considers the role of a city's community — its people's response to shocks and climate impacts.

These initiatives can strengthen the resilience of a region's community in multiple ways. For example, Cape Town, South Africa has a partnership with local energy companies to install over 160,000 solar water heaters. This promotes a more diverse and resilient energy supply, while boosting local business revenues. Quito, Ecuador, faces considerable risk from seismic movements, floods and forest fires. In 2011, 144 landslides resulted in many deaths and damage to housing in the most vulnerable sectors of the city. AECOM's support for the city through the Rockefeller Foundation's 100 Resilient Cities program will bring together stakeholders from across industry and government to create an agenda for building greater resilience.

While the costs of these initiatives can be significant, there are a number of financing mechanisms available to fund lasting mitigation measures.

"CITIES NEED TO CLEARLY COMMUNICATE THE ADVERSE CONSEQUENCES OF DOING NOTHING AND HOW MEANINGFUL INVESTMENTS CAN PROVIDE CURRENT AND FUTURE COMMUNITY BENEFITS." Claire Bonham-Carter, director of sustainable development, AECOM

¹*R*!*SE partners include*: UN Office for Disaster Risk Reduction (UNISDR), PricewaterhouseCoopers, the Economist Intelligence Unit, Florida International University, Principles for Responsible Investment, AECOM and insurance broker Willis.

²CDP, Protecting our capital: How climate adaptation in cities creates a resilient place for business, 2014.

AECOM professionals in this field are listed on page 106.





ENHANCING THE USER EXPERIENCE

Sacramento Kings Entertainment and Sports Center Sacramento, California, U.S.A.

The second second second second

Taken of the

The way we think about the performance of the spaces we build is radically

changing. In the past, simple measures such as cost have often been used to gauge the functionality of our buildings. But in today's complex and accelerated marketplace, the functionality of these places is based not just on how much they cost to build or operate, it is also based on how these spaces are used and enjoyed by those who live, play or work in them. In an age of increasing competition, owners who focus on successful user experiences will unlock higher revenues and lengthen the life of their assets.

Better use of our spaces also relies on assets evolving with the changing needs of the communities they serve. Buildings need to work in unison with their surrounding area, particularly as increasing urban development means space comes at a greater premium.

In this section, we consider how sporting organizations and venues are adapting to changing audiences, and in turn, how venues are bringing about change in their communities. And this dynamic is not just limited to the sports and leisure sector. In office buildings, health care environments and many other building types, we are also seeing new ways of thinking and measuring building functionality.

Sports venues

More than a game — improving the fans' experience

There has never been a more exciting time for the business of sport. We are seeing significant increases on the financial side, as sports broadcasting revenues, team valuations and athlete salaries all grow. And with this comes greater demand for and investment in building high quality, expensive arenas and stadia. But the key question is, can audiences grow to match and support these investments, and if so, how? And as sporting organizations move forward with new venues, how can owners be sure they are building in a smart way, and building to match capacity?

As audiences change rapidly, building a business model to attract them can seem like trying to hit a moving target. How can owners be sure they are making the right investments?

In sports venues, we would propose flipping the traditional equation that drives revenue. This means setting our sights on increasing:

- LOYALTY
- EXCITEMENT
- TRANSFORMATION
- REVENUE

If fans are truly loyal and excited, then the venue will transform their communities, and revenues will follow. This seems like a simple statement, but by flipping the focus from revenue to the fan, sports organizations around the world can radically transform their business and their cities.

"IF FANS ARE TRULY LOYAL AND EXCITED, THEN THE VENUE WILL BE TRANSFORMATIVE, AND REVENUES WILL FOLLOW." Adam G. Williams, director, global sports group, design + planning, AECOM

Creating LOYALTY

In order to be more compelling, venues must create loyalty. They must resonate with users on an emotional level. They must be exciting, interesting, and most of all allow multiple experiences within the same space. This requires a clear understanding of a venue's patrons. While most sports teams have a good understanding of their current fan base — the sports fan — it can be challenging to determine who any future new audience members might be. Sports fans are an intensely loyal group who can be reached relatively easily, but the challenge lies in creating new sports fans.

Who are those new audiences and what would compel them to come to games? Quantitative and demographic studies provide a baseline view, but qualitative studies open up the opportunity for real breakthroughs. For example, research for a sports apparel manufacturer yielded a sub-group that we call "nerdy adventurers;" sports fans rooted in nostalgia, with an interest in statistics.

These "nerdy adventurer" fans do not identify with the more public representations of sports fans, but they are methodical about purchases and they have disposable income. For these users, the club spaces and seating sight lines are less important than the technology component, and having a tailored experience in the interstitial spaces the food, concourse design and entrance sequence. This group presents a clear opportunity for the venue to engage a new set of fans by designing a relevant experience, one which connects the visitor experience from end-to-end with curated touchpoints along the way. The "nerdy adventurer" is just one example of a new audience type.

While it is critical to understand different types of patrons, it is also important to consider them as part of an ecosystem: to understand who the priority audience is; which needs are compatible; and how best to negotiate these different constituencies in shared spaces.

Workplace case study Getting more from existing workspace National Grid, United Kingdom¹

Understanding current and future workplace requirements led AECOM's Strategy Plus team to radically redesign 22,686 square meters of floor space at National Grid's HQ enabling greater efficiency in use of space and an increase in employee productivity:

- £10 million (US\$16.2 million) saved in annual operating costs
- 15 percent increase in desk utilization
- 16 percent drop in energy consumption
- five percent rise in productive time per person thanks to better availability of meeting spaces
- five percent increase in collaborative activity per person.

¹Nicola Gillen & Hilary Jeffery, See further: The next generation occupier issue, AECOM, 2014

The "nerdy adventurer" fan



Sustaining the EXCITEMENT

As audiences become more complex, sports venues are also becoming increasingly diverse. A recent AECOM study quantified the "honeymoon period" of a new venue's increased attendance. It also showed a post-honeymoon dip and the need to make facilities more productive — beyond the honeymoon period and in the off-season.

One way to do this is by amplifying the game-day experience as an integral part of the design. For some fans, access and experiences are priceless. New forms of premium seating offer previously inaccessible spaces, such as seating next to team benches in America's National Basketball Association or field-level suites in its National Football League (NFL), and can command the highest prices.

While investment in sports venues is increasing, there is also a counter trend of reduced seating capacity to increase exclusivity and create a more intimate atmosphere. In Major League Baseball, for example, only two of the 14 stadiums built since 2000 have more than 45,000 seats (and they are in the strong baseball markets of New York, New York and St. Louis, Missouri).

Health case study

Understanding different patient needs Park Nicollet Women's Center, St. Louis Park, Minnesota, U.S.²

Experience mapping is an important step in helping to create more appealing and productive places when reconfiguring new or existing health care assets.

AECOM worked with clinicians and administrators to identify four key patient types. This informed the design and identified opportunities to enhance the patient experience.

²Sheila F. Cahnman, "Designing for the patient experience", *Healthcare Design*, May 28, 2014

Better food and drink areas can also help entice fans. At Seattle's Safeco Field, in Washington, U.S., turning the tired Bullpen Market into "The Pen" (with higherend offerings) increased sales.

Technology has also helped enhance patron experiences with paperless or variableprice ticketing, and loyalty programs. These help teams learn about the demographics and preferences of their fans.



Stadium attendance honeymoon period

"UNDERSTANDING THE MOST EFFECTIVE USE OF RESOURCES TO IMPROVE PATIENT SATISFACTION WILL BE IMPORTANT IN AN AGE OF DIMINISHING REVENUES." Christine Devens, associate principal, design + planning, AECOM

Venues also need to be flexible in their design in order to maintain levels of engagement and excitement. Efficient adaptation of spaces may include venue capacity; multiple configurations such as a tennis court, concert stage, ice-rink or competition pool; and repurposing into restaurants or clubs can reinvigorate previously "dead" space. These strategies might not be new, but the pace and scale at which they are being implemented is increasing. By placing a greater focus on the overall patron experience, improved and sustained revenue can outpace that earned from traditional service models.

Enabling TRANSFORMATION

Sport venues are often hailed as catalysts to key urban transformation. But this does not occur by chance; it relies on establishing a framework whereby the venue can help achieve the ultimate ambition for an area.

A successful transformation encompasses everything surrounding the venue, either on gameday or at other times. Game-day experiences can be extended through nearby hotels, retail, bars and restaurants which sometimes create their own momentum. In the American NFL, where most in-bowl revenues are shared, these developments can be invaluable to team owners. Prime examples include London's O2 Arena; Lambeau Field Atrium in Green Bay, Wisconsin, U.S., that has helped put the Packers in the NFL's top ten revenue list; and LA Live and the Staples Center that have transformed a deserted downtown area of Los Angeles.

Sports venues can also anchor facilities not directly related to gamedays. Sports management offices, or facilities for education, research or conventions may benefit from proximity to a venue from a brand perspective or through shared use of common areas. In London, the legacy of the Olympic Park is leading the regeneration of East London, with the park, venues, and soon-to-be-built homes and offices working as a collective whole.

This is an exciting proposition for sports architecture. On the one hand, there is increased financial investment and therefore more pressure to perform. But on the other, there is a shift in perceptions of building functionality, with more nuanced metrics being measured than simple cost and occupancy models. With this change comes a renewed focus on the fan — building a loyal audience and creating exciting experiences is central.

Precinct value generation Community asset Venue City transformation Athlete and owner demands Spectator expectations

City-precinct-venue

We are also seeing sports venues as a tool for urban transformation, building on the complex relationship between the development, its audience and the community it serves.

The way buildings and other assets work together at a campus, or a precinct level, and beyond that, as part of a whole city or town, is enabling further urban transformation and more efficient use of the spaces we inhabit.

"THIS IS EVIDENT IN THE EFFICIENCIES TO BE GAINED FROM OUR EVOLUTION TOWARDS A MORE CONNECTIVE AND PERMEABLE URBAN ARCHITECTURE." Andrew Laing, Strategy Plus director, AECOM

This neighborhood approach fosters more productive spaces. It blurs the boundaries between buildings and the city, while also creating environments where many different kinds of social events, shared spaces or curated experiences can be hosted. This is being encouraged by advances in technology that are helping us to rethink how we work and live across all kinds of spaces.

Creating effective precincts

Connective and permeable urban architecture³ requires:

- Public or semi-public places provided for working collectively
- Multi-functional buildings
- Planned juxtaposition of complementary uses
- Places that support serendipitous interactions between businesses and other users.

³Andrew Laing, *Work and workplaces in the digital city*, Center for Urban Real Estate at Columbia University, 2013.

Segregated approaches to city planning are being challenged by multi-functional buildings that enable a more intensified use of our cities' spaces.

This permeable, open approach, allows new degrees of accessibility to our buildings — be they the more traditional private realms of offices, or our stadiums, shopping centers or hotels. These spaces will be designed and retrofitted to suit the evolving needs of locals and the business community, minimizing the amount of empty, private and unproductive space in our future cities.



INNOVATIVE CONSTRUCTION

Marks & Spencer Cheshire, United Kingdom

Construction technologies, materials and processes are becoming more sophisticated in response to demands for greater efficiency. Industry

advancements in manufacturing and customization are creating a shift away from traditional methods of construction. Often these are not completely new inventions, rather old ideas applied in new ways or using new tools. And despite additional initial costs for more advanced materials and processes, owners and developers are being increasingly won over by significant savings in time, increased quality, environmental efficacy and an enduring appeal.

Timber gains ground

One clear outcome of changing manufacturing technologies, and the drive for more productive and sustainable approaches in construction, is the rise of engineered timber. A well-established yet niche solution in many parts of Europe and the Americas, engineered timber is now gaining ground in other parts of the world.

Predominantly manufactured in Europe, North America, and New Zealand. there are three main types of products available. Cross-laminated timber (CLT) is made by gluing together timber logs that have been split into smaller pieces. This reduces the effect of natural timber variability and provides greater strength, with modern manufacturing ensuring precision customization. Laminated veneer lumber (LVL) is made of thin veneers of timber, enabling more complex shapes and the highest strength of all engineered timber. Glulam is similar but can be crafted into longer or curved pieces, and is more visually appealing than IVI and CIT.

Beyond its physical benefits, engineered timber can also strengthen the feasibility of a new build or conversion. Apartment buildings, for example, are typically able to achieve around a 30 percent saving in project duration, as the timber can be erected faster and trades can commence work earlier. While there is a more intense period of design at the beginning to get the manufactured elements just right, bringing these design smarts to the fore reduces on-site complications.

Also, in the growing field of building adaptation, lightweight timber solutions often allow more capacity to be built on to existing structures — for example, increasing the number of apartments built into additional levels.

As a greater understanding of these products takes shape, engineered timber will play an even greater role in a diverse range of building types. Marks & Spencer's Cheshire Oaks flagship store in the United Kingdom features a combination of engineered timbers in its environmentally-optimized design solution. The roof structure is glulam rafters under LVL, constructed entirely from responsibly sourced renewable timber from FSC certified sources. Horizontal forces that developed in this unconventional roof structure were resolved through supported "tree" columns into the suspended floors below.

Timber has also enhanced projects such as the University of the Sunshine Coast's Engineering Futures building in Australia and the Blue Mountain Ski Resort in Canada, where AECOM worked in partnership with Normerica Building Systems. Here, the challenging shape of the building created unusual snow and wind loads, which had to be addressed in the design. New manufacturing sources of engineered timber are expected to follow this rise in demand, easing shipping costs and panel size constraints. For example, in the United States, the Department of Agriculture has already announced its support for wooden high-rises as part of its climate change mitigation approach.

In Singapore, the Government is driving greater efficiencies by mandating the use of precast components. These include prefabricated, prefinished, volumetric construction for hotels and residential projects and CLT for low- and mediumrise buildings. Singapore's Building Construction Authority endorses the use of these productive technologies to speed up completion on buildings, reduce dust and noise, and the risk of on-site accidents.

These developments demonstrate how the practice of fabricating architectural elements in either part or whole under manufacturing conditions is gaining ground. This off-site method allows a more finely-honed process, away from the unpredictability of weather or other site risks. Sophisticated, customized solutions are created through processes that also increasingly enable material resources to be used from a closed-loop, maximizing re-use and flexibility.

Nanotechnology — small world, big impact

Another materials innovation that is helping transform building design and construction is nanotechnology.

In Russia, nanotechnology is being advanced across several sectors. AECOM worked with RUSNANO — the Russian agency tasked with stimulating growth of the country's nanotech innovation industry — to advise on the cost-effective introduction of nanotechnology-based products to Sochi 2014 Winter Olympic venues to improve environmental standards.

This followed a successful collaboration with RUSNANO and the Government of the Chuvash Republic on the AECOMdesigned "Energy Efficient House of the Future," which features innovative nanoenabled materials, making it 30 percent more energy efficient than typical structures in Russia.



"BY 2025, OVER 50 PERCENT OF BUILDING MATERIALS ARE EXPECTED TO CONTAIN NANOMATERIALS AS MORE TAKE ADVANTAGE OF THESE LIGHTER, STRONGER, AND MORE ENERGY EFFICIENT MATERIALS." Bill Looney, director of AECOM's nanotechnology initiative

The use of nanotechnology enhanced building materials offers many advantages, including:

- Lighter, stronger composite materials
- Stronger, more weather resistant cement
- Improved resistance to fire through nanocoatings
- Significantly improved thermal protection (The most thermally efficient material known; nano aerogel insulation)

- More energy efficient quantum dot-enabled LED lighting
- Treatment of airborne pollutants by nanofiber air filters applied to building façades
- Temperature reactive thermochromic windows that reduce heat load
- Greater self-sustaining energy from new solar cells that use nano-ink instead of silicon and nano-enabled energy storage devices.

These developments highlight the benefits of greater collaboration between businesses, academia and industry groups. AECOM's studies in this area are ongoing and include alliances with leading academic institutions on pioneering nanotechnology-based solutions.



The "Energy-Efficient House of the Future"

The "Energy-Efficient House of the Future," designed by AECOM for the Government of the Chuvash Republic and RUSNANO Corporation.

Navigating complexity in construction

Careful management of complex construction processes can lead to significant gains in efficiency, even on the most ambitious of projects. Staging, early design interventions, and rigorous modeling of scenarios can improve project efficiency, creating better outcomes for the community. These methods are becoming more important as project teams deal with existing urban structures and systems, while striving to minimize delays and keep local neighborhoods in action.

A comprehensive constructability review can provide engineers and architects with guidelines to help a project proceed smoothly. Early collaboration with the client and design team can have a dramatic effect on project values and costs, helping to optimize the concept.

Finding innovative responses to structural design, sustainability, optimization of floor plates, and other alternative methodologies can shorten the construction program, easing the financial costs and reducing the construction price risk. Greater savings can be made by phasing works to allow staggered opening, providing earlier income streams and enabling works to be carried out concurrently.

Building Information Modeling (BIM), a key tool during these early stages, can help identify constructability issues, right-of-way and construction staging concepts. Project models also facilitate estimating, procurement, clash detection, field management and the identification of safety hazards. "TO SUPPORT THE 3.5 MILLION-SQUARE-FOOT TOWER, IT WAS NECESSARY TO BUILD DOWN INTO THE THICK MANHATTAN BEDROCK. TO OVERCOME THE CHALLENGE OF BUILDING AROUND THE PATH TRAIN, MUCH OF THE WORK HAD TO BE DONE BY HAND ... IT WAS A SURGICAL APPROACH." Dan Tishman, chairman and CEO of Tishman Construction, an AECOM company

Achieving these efficiencies requires working with a highly specialized team with experience of managing the construction of complex mega-projects. Tishman Construction, an AECOM company, is known for building iconic skyscrapers and developments around the world, including the original World Trade Center's signature Twin Towers in New York. Implementing lessons from its tall building expertise was particularly relevant in tackling the challenges presented by rebuilding the new World Trade Center site.

Tishman is providing pre-construction and construction management services for Towers 1, 3, 4 and 7, the Transportation Hub, and the Vehicle Security Center on the complex 16-acre site. Dan Tishman, chairman and CEO of Tishman Construction, explains the careful approach required for the Port Authority of New York and New Jersey's 1,776-foot (541-meter) One World Trade Center building, such as navigating around the operational Port Authority Trans-Hudson (PATH) train: "To support the 3.5 million-square-foot tower, it was necessary to build down into the thick Manhattan bedrock. To overcome the challenge of building around the PATH train, much of the work had to be done by hand, without heavy machinery. You had people down there with picks and shovels and miniexcavators, maybe digging a foot a night. It was a surgical approach."

Innovative approaches are also required to keep the community safe and ensure business continuity during these complex builds. AECOM has also developed the Cocoon Safety System, implemented during the 104-storey One World Trade Center construction, and many other complex builds. This multi-level, vertical netting rises as the structure is built. It is wrapped around buildings under construction, preventing materials, tools and even workers from falling.

In Hong Kong's Victoria Harbour, the Wan Chai Development presented a similar challenge to keep rail services operating. As part of phase two of this major waterfront project, AECOM developed a 46,000-ton precast concrete structure to take up reclamation and traffic loadings, helping to avoid adverse impacts on the live railway tunnels underneath the harbor.

"IT WAS A COLLABORATIVE OUTCOME WHERE ALL PARTIES PLAYED AN IMPORTANT ROLE, AND WITHOUT A COORDINATED PLAN, THIS MEGA UNIT WOULD NOT HAVE BEEN INSTALLED SUCCESSFULLY IN THE VERY BUSY VICTORIA HARBOUR." Francis Leong, director, water and urban development, AECOM

Innovation and safety were central to the design, fabrication and transportation of this precast unit, which is the size of a football field. It had to be towed through the harbor into position, over a period of 24 hours — a precision operation requiring careful communication with authorities.

This project will enrich Hong Kong's quality of life. The land formed by the project will be developed into a world-class waterfront for the public to enjoy.



RESTRUCTURING LABOR

Denver International Airport Denver, Colorado, U.S.A.

In an effort to improve long-term industry productivity, many countries are working to create a sustainable labor force that retains industry knowledge.

This requires the introduction of innovative processes and a construction workforce that is less reliant on transient flows of workers. These mechanisms will drive the highest value from the local labor force, and minimize the short-term impact of migratory workers.

Five key areas are reshaping the value proposition of an alternative labor force structure:

- Prefabrication mandates
- Foreign worker restrictions
- Financial innovation incentives
- Competitive labor pricing
- Global collaboration.

In many instances, governments are driving productivity-enhancing reform in construction delivery. A common component of these reforms is adjustments to labor force composition, which has interlinked immigration policy with construction innovation targets.

Productivity-enhancing reforms are systematically altering the demand and skills required on-site and off-site.

Existing initiatives that encourage the use of productivity enhancing processes are increasingly including clauses that place restrictions on the use of domestic versus foreign labor.

In **Singapore**, the government continues to take progressive steps to raise the quality of the local construction workforce and moderate foreign employment growth. Quality economic growth driven by sustained productivity improvement is leading to new market restrictions and incentives. Singapore's reliance on foreign labor within the construction industry has reached up to 50 percent on some projects. In light of this, the Singapore authorities have implemented a series of measures to reduce the reliance on foreign labor:

- Reducing Man-Year Entitlement. The quota of construction workers allowed on new projects has progressively reduced by 45 percent since 2010. Modifications to the ratio of foreign labor dates back to the work permit allocation system in 1998.
- Increasing the foreign worker levy paid by main contractors for each worker.
- Mandating the use of precast components.
- Encouraging adoption of productivity measures through the introduction of a S\$250 million (US\$197 million) Construction Productivity and Capability Fund (CPCF).

The introduction of the CPCF aims to raise productivity in Singapore by 20 to 25 percent by 2020. Restrictions on foreign labor have had an immediate effect on local job creation — 63 percent of new jobs went to locals in 2013, up from 47 percent in 2012.

"THE REDISTRIBUTION OF LABOR WILL IMPACT THE STRUCTURE OF THE INDUSTRY. PROJECTS ADOPTING PREFABRICATION ARE CITING ON-SITE LABOR COST SAVINGS AS HIGH AS 40 PERCENT ALBEIT WITH A RISE IN OVERALL MATERIAL COSTS." Michael Skelton, market strategy and business intelligence, AECOM

Labor force restrictions are having an immediate effect on the ratio of foreign labor in Singapore's employment market



Source: Singapore Ministry of Manpower

Malaysia continues to advance its Industrialized Building System (IBS) roadmap in an effort to accelerate the adoption of construction industrialization, mechanization and block systems, and the use of prefabricated timber structures.

Over the years, the Malaysian program has progressively altered the construction industry's approach to prefabricated construction and therefore the roles and volume of labor required.

The Malaysian Government's program puts greater emphasis on standardization across the prefabrication market with the intent of avoiding non-compatible modular design that would inhibit industry competition.

The success of the IBS program is paying dividends in the nation's overall productivity, with construction sector labor productivity growing by an impressive 5.2 percent in 2013, surpassing many advanced economies. While prefabrication mandates only impact government projects, improvements in efficiency and capacity to deliver such projects will ultimately flow through to the private sector.

This progressive industry reform may lead to the repositioning of a former on-site construction worker to an off-site fabrication and assembly team.

"RETHINKING DESIGN AND CONSTRUCTION PROCESSES IS THE WAY FORWARD AMID A TIGHTENING LABOR MARKET. CLIENTS WILL BENEFIT FROM APPROACHES THAT ARE LESS LABOR INTENSIVE AND MORE EFFICIENT IN PROJECT DELIVERY." Billy Wong, senior vice president, AECOM

In the **Middle East**, the Gulf Coast countries have adopted a common approach to monitoring the proportion of foreign workers and their countries of origin. Saudi Arabia, United Arab Emirates (U.A.E.) and Oman run programs encouraging greater local workforce participation, mindful that in some cases, for example the U.A.E., approximately 80 percent of the population consists of expatriates.

Enforcing minimum local labor force standards is not without significant challenges. Many nations, both developing and developed, face difficulties sourcing the appropriate caliber of skills. The demands to meet short-term labor force productivity improvements can come at the cost of a longer-term agenda aimed at building a stable, in-country sustainable trade labor force.

International comparison of trade labor force entitlements

Beyond the regulatory barriers to migration, countries around the world also compete for labor on a number of other factors, such as employee entitlements.

Variations in the fully-loaded cost of labor can have a marked effect on project costs and capital efficiency. The relative strengths of local economies, the influence of trade unions, and the extent of regulations and bureaucracy all impact construction labor force entitlements.

Hours worked per week





Source: AECOM Research

¹CFMEU: Construction, Forestry, Mining and Energy Union ²CIJC: Construction Industry Joint Council ³BATJIC: Building and Allied Trades Joint Industrial Council

Sample of unique components of construction labor force entitlements

Australia: Rostered Days Off based on 2013 CFMEU¹ Victoria on-site 36-hour week agreement, plus one paid day off per year to attend union picnic. Leave loading of 17.5 percent (only country with this).

Europe: The European Union Working Time Directive stipulates a minimum of 20 days annual leave. CIJC2 and BATJIC3 Working Rule Agreement consists of 29 days annual leave, including public holidays.

New Zealand: 20 days annual leave paid at the employee's average hourly rate, based on the previous 12 months of work.

United Arab Emirates: Annual leave of two days per month for any employee with more than six months but less than one year of service. 30 days annual leave for employment exceeding one year.

United States: Federal law does not require employers to provide paid vacation; this is set by individual employers. Most union contracts include paid leave. Leave is paid by the union. Employers make hourly pay contributions to the union leave fund for each worker. Average annual leave is 12 days although 25 percent of the construction workforce receive no paid annual leave or paid public holidays. Variations to this typical scenario exist between states.

Singapore: Seven days of leave on first year of service. Additional one day for every subsequent year until a maximum number of 14 days.

South Africa: Leave must be taken over a consecutive 21 days (15 days leave plus weekends, but excluding public holidays). If leave does not coincide with forced shutdown periods, unpaid leave must be taken unless negotiated with employer.

Effective 24-hour work cycles

Global mobility of design and consulting project teams has taken on a virtual rather than physical presence.

The effective use of technology and collaboration tools is enabling a new era where 24-hour work cycles are becoming part of the productivity suite.

Construction markets across the globe are currently experiencing varying workloads, which means that, in some locations, spare resources are available. However, invariably, these resources are not easily transplanted to where their efforts are required.

For example, AECOM has successfully implemented 24-hour work cycles on a recent project in Abu Dhabi, managing deliverables through the effective collaboration between the managing Abu Dhabi office and the production office in Los Angeles. The majority of the project's design and production team were based in Los Angeles, however, the client-facing management team was based in Abu Dhabi. In order to accommodate project design schedule demands and assist the American team to implement Abu Dhabi industry design standards, an effective 24-hour work cycle was established based on the complementary time zone differences.

Key to the effective delivery of such a challenging project is the temporary relocation of a few key personnel from the managing office. They help the production office address any matters that might arise overnight in the secondary office and ensure design practice standards and requirements are met. These minor relocations ensured a much higher success rate for the project by building trust on both sides of the project team and enhancing the team dynamic between the two locations.



The 24-hour work cycle

Ultimately, the desired productivity from a 24-hour work cycle is dependent on effective management. There are four core elements of a successful 24-hour work cycle team:

- proactive, constant communication
- defined process and protocols
- a single source of truth one model
- trust.

In other instances, the application of these core elements is fundamental for successful collaboration between highvalue design centers and project teams.

"TRUST AND UNDERSTANDING BETWEEN PROJECT TEAMS — NOT ENABLING TECHNOLOGY — WILL ULTIMATELY DETERMINE THE SUCCESS OF A 24-HOUR WORK CYCLE" Elizabeth Peters, BIM manager, AECOM Behavioral characteristics can help or hinder collaboration on projects.

At an individual level, people have the capacity to adapt their own approach towards others. However, additional factors, including contractual arrangements can restrict the capacity of the human element to deliver more productive outcomes.

Global working environments are required to collaborate, more so today than in past working methods. Despite technological advancements that improve collaboration and productivity, project success resides within an open, trustworthy, actively communicating project team.

Accessibility to leading knowledge, whether it is locally sourced or internationally gathered, remains the key ingredient to building global best practices, irrespective of regulatory labor programs.



TECHNOLOGY TRANSFORMING INDUSTRY

Cape Town Stadium Cape Town, South Africa A growing number of organizations around the world are mandating the use of Building Information Modeling (BIM) as a way of delivering projects. They are also starting to capture, store and analyze their operational and market data.

These changes are leading to closer ties being formed between business operations and construction delivery. We are at a crossroad where previously disparate pieces of information are being combined and immense value is being uncovered.

While technology has been the conduit for change, it has been accompanied by significant developments to processes, greater openness towards information and changes to our behavior.

"SMART SYSTEMS THAT COMBINE PROJECT DATA WITH OPERATIONAL SYSTEMS ARE BEGINNING TO INFORM BUSINESS DECISIONS, LEADING TO GREATER EFFICIENCIES. BY LINKING SYSTEMS IT IS POSSIBLE TO ACHIEVE VALUE GREATER THAN THE SUM OF THEIR INDIVIDUAL PARTS." Steve Appleby, BIM practice lead, AECOM

Industry participants continue to debate what return on investment BIM adoption brings. However, the focus should really be on the need to conform to best practice. BIM's holistic approach to project delivery represents a significant structural change for the construction industry.

When considering the shift in market perceptions towards BIM, it is clear that market size is perhaps the most dominant factor influencing industry rates of change. We have seen many reports and conferences debating the drivers and barriers to BIM adoption; U.K. market commentators suggest that despite the government's BIM mandate being in place since 2012, the expected rate and depth of adoption has not been achieved.

Conversely, in Australia where only two years ago the rate of BIM adoption was considered to be behind the rest of the world¹, the relatively smaller-sized market has enabled a faster transfer of knowledge across the industry. As a result, the former industry laggard has used its agility to become an industry leader, suggesting that the fewer points of contact that exist, the faster the transformation can occur.

"UNDERSTANDING UNIQUE MARKET NUANCES IN COUNTRIES ACROSS THE GLOBE WILL DRIVE MORE EFFECTIVE EXCHANGES OF INFORMATION TO BOOST INTERNATIONAL PRODUCTIVITY." Graham Jones, director, AECOM

Property, construction, resources and infrastructure industries are investing more to align their data and produce informed analytics that support decision making.

The value proposition of this analytics approach has evolved in recent years to include more integrated systems:

CAD

BIM

Integrated BIM and GIS

Centralized aggregated model data (extract, transfer, load systems)

Analytics (queries and predictive)

As the industry increases its capability and capacity to use BIM, the demand for its use becomes greater and more sophisticated in nature. Project deliverables are increasingly exceeding simple 3D modeling methods and establishing new information-led standards for project delivery.

The underlying value of this information over time is not easily quantified. Therefore, a holistic view of the overall benefits must be considered instead of measuring equivalent hard costs.

Value added versus waste in the manufacturing and construction industries





Source: Eastman et al., *BIM Handbook*, 2008, John Wiley and Sons, Hoboken, NJ

History reveals that the construction industry has often trailed behind other industries on the innovation curve. Adoption of technology and its associated benefits is no exception. The manufacturing industry has been adopting product delivery processes and standards similar to BIM over the past two decades; the result is a far more efficient industry.

However, an unintended benefit to the construction industry is the formation of aspirational targets based on comparative benchmarks. As a result, many nations are adopting roadmaps to guide the industry towards these goals.

In many cases it is not technology holding back innovation but rather the social and behavioral elements of the industry.

Technical core
BIM (model) Linked content Information management
Social/behavioral integration
Institutional and cultural framework

The sheer size and complexity of some of the mega projects being planned, designed or constructed, requires an entrepreneurial, innovative edge to achieve their time, cost and quality ambitions. These scenarios provide the perfect setting for unprecedented innovation in project delivery.


Case Study King Khalid Medical City Dammam, Kingdom of Saudi Arabia

When completed, King Khalid Medical City (KKMC) will be the region's leading facility for tertiary referral health care, housing a 1,500-bed hospital, research center, staff accommodation, conference centre and administrative office building.

The KKMC project vision is to build a costeffective, smart academic medical center that incorporates evidence-based design and provides a healing environment for patients, families and staff.

Health care is one of the most complex sectors of design and construction in the world. Therefore, AECOM's provision of a full multi-disciplinary design and cost management service on the US\$1.2 billion project required world-class innovation in delivery.

Design considerations included:

- room information management
- engineered system design
- stakeholder and user group input
- shifting health care technology
- rapid adjustments to cost modeling.



Using the workflows and modeling techniques that BIM offers, the project could be efficiently managed with contributions from across the globe.

Factors that determine project success must be in place at the outset. All participants need to understand how models should be setup, how progress is measured and viewed, who has responsibility for which particular components, who has specialized BIM skills and when items should be modeled.

Documents outlining these protocols ultimately led to more efficient project delivery of:

- the project execution plan
- the communications plan
- BIM standards.



Global collaboration delivering world class health care

Strategic lifecycle asset management

The integration of BIM and Geographic Information Systems (GIS) technology is revolutionizing the way property and infrastructure assets are planned, designed, delivered and managed throughout the project lifecycle.

Although BIM and GIS have been embraced by asset owners independently, most of this information is stored in separate databases that cannot "talk" to each other, leading to the duplication of effort, uncertainty in the validity of information and more complex management of separate workflows. Complex organizations require fast and reliable access to vast amounts of information. When data is transferred from one system to another, this leads to the potential for reduced accuracy as the margin of error increases.

The integration of BIM, GIS and asset management technology removes these issues by providing access to current, consistent and reliable data to inform and speed up robust decision-making processes, while poor asset management systems and processes can lead to avoidable financial costs.

	TASK	APPROACH	OUTCOME
VALIDATE	Validate business requirements	Systems, procedures and standards to allow an organization to record, map and manage its assets and operations through a GIS, BIM, asset management integrated technology platform	Fundamental review of current practice and value of adopting integrated asset management platform
M	Review existing system structure	What data exists? How is it collected and stored? What attribute data is required for lifecycle management?	BIM/GIS standards for the collection and management of asset management data
M			
RE	Review adequacy of resourcing requirements	Integrating the digital flow of data across planning, design, development, delivery, operations and maintenance requires specific capabilities to manage the process	Organizational chart for integrated engineering department
	Technology upgrade options assessment & procurement	Develop technical specification and assist scoping of procurement process to bring latest technology to the organization	GIS/BIM/Data normalization hub
DEVELOP	Develop return on investment (ROI) metrics	How does the new system differ from the status quo? What is the operational expense profile? Set reduction targets	Develop benchmark for operational expenditure profile to capture and measure return on investment
	Develop implementation roadmap	Staged implementation roadmap for the tools, standards and resources required to ensure positive return on investment in the shortest timeframe	Comprehensive asset information platform that supports the sharing of data across the business

Implementation of a strategic lifecycle asset management plan

To achieve a more predictable and optimal budget with lower contingency to cover uncertainty, the information management strategy must focus on reducing the risk of capital and operational investment. Successful implementation of an integrated plan will ultimately avoid unscheduled costs and allow organizations to deliver and operate more productive assets.

Implementation of integrated project delivery and asset management system





ALTERNATIVE FINANCING

The Governor George Deukmejian Courthouse Long Beach, California, U.S. A. Image: Long Beach Judicial Partners

ARR JUD!

In many parts of the world, public-sector budgets are coming under increased

pressure. But as our cities grow, we are also seeing greater demand for billions of dollars of investment in new or improved infrastructure — from roads and rail, to schools and hospitals.

In this restrictive funding environment, many public organizations are considering alternative or hybrid procurement methods to address pressing infrastructure needs.

The challenge for governments seeking to fund infrastructure in a post-financial crisis environment is to develop transaction models that:

- Provide long-term investors with low-risk, inflation-linked returns.
- Avoid the creation of additional risk through artificial financing structures.
- Use existing financing concepts which are known to investors.
- Unlock better, earlier and cheaper project outcomes through more sophisticated design and prioritization of major projects that also considers policy, commercial, financial and risk transfer.
- Maximize the quantum of private-sector finance to support the project.
- Reduce costs associated with the bidding process.

"THE MOST EFFECTIVE VALUE CAPTURE PROGRAMS CREATE MORE PRODUCTIVE CITIES BY STIMULATING ECONOMIC DEVELOPMENT, INCREASING EMPLOYMENT GROWTH BY IMPROVING ACCESS TO JOBS, AND EXPANDING HOUSING OPPORTUNITIES TO MEET LOCAL CONDITIONS."

Philip Davies, director, infrastructure advisory, Asia-Pacific, AECOM

Value capture for urban renewal

In the United States (U.S.), land value capture programs have become the most common method of funding urban renewal programs, typically contributing between 10 and 20 percent of capital costs in well-designed programs. The United Kingdom (U.K.) recently adopted this funding model to help pay for Crossrail, where it is contributing around 25 percent of this £17 billion transport project.

Value capture programs focus on tapping the incremental revenues resulting from long-term, well-integrated land use and transport programs, and can be more equitable in funding public improvements than traditional sources, such as levies and user charges. Successful programs recognize that increased funding streams do not simply result from population and employment growth; they are the result of a combination of elements, including:

- Well-conceived and integrated transport and land use planning.
- Targeted public investment in carefully selected improvement precincts and projects.
- Incentives which attract complementary private-sector investment.

Value capture funding methods are proven sources of funding urban renewal and transport infrastructure in the U.S., Canada, France, U.K., Brazil and other countries.

Public-Private Partnerships

Public-Private Partnerships (PPP or P3) are increasingly being adopted around the world as a means to deliver social and civil infrastructure where shortfalls in public-sector funding exist.

Modern PPPs were first implemented in the 1990s as a result of public debt challenges. While there was very little framework around the delivery of early projects in the U.K. and Australia, the U.K.'s Project Finance Initiative formalized the first programmatic framework for PPPs. A rapid uptake by the industry followed.

PPPs help achieve an efficient allocation of risk and reward between the public and private sectors to deliver and finance a service for the community's benefit. Through this partnership, the public and private sector share the risks and rewards of services traditionally delivered wholly by the public sector. This enables projects to be completed faster and within budget, thereby achieving better value-for-money outcomes.

The design-build procurement mechanism is the first step of a public-private partnership. The procurement process transfers greater risk — traditionally retained by the public sector — to the private sector to achieve improved efficiencies, innovation and performance.

Essential to the decision-making process is the development of an appropriate process by the procuring agency, based on a comprehensive understanding of the PPP process. A sufficiently robust assessment of alternative models also needs to be completed.

It is of critical importance that the value for money associated with the selected approach is clearly communicated to key stakeholders, such as taxpayers.



Relationship between time, cost and risk between traditional and PPP models

The rise of public-private partnerships



Department of Economic Affairs, Ministry of Finance, India

The private sector will bear the burden of risks and provide savings and budget certainty to the public through the transfer of risk over the lifecycle of the project.

Drivers of savings:

- Optimal allocation of risks
- Design and construction efficiencies
- Focus on whole-of-lifecycle costs
- Integrated planning and design
- Private-sector management and control.

In addition to the financial and legal framework, a truly effective PPP structure incorporates highly collaborative teams, as distinct from more traditional project models that have suffered less positive outcomes because adversarial behavior was allowed to develop. AECOM Capital was founded in 2013 as the global investment fund of AECOM with expectations to make direct investments in real estate and public-private projects as a joint venture partner.

The investment platform provides an opportunity to play an important role in development projects. It is responding to an evolution in the buildings and infrastructure market where alternative delivery options are sought, where partners can provide project financing, along with traditional services.

"AECOM CAPITAL WAS CREATED TO PROVIDE FINANCING FOR BOTH P3 PROJECTS AND GROUND UP REAL ESTATE DEVELOPMENT PROJECTS, THEREBY OFFERING AN INTEGRATED DELIVERY METHOD TO OUR CLIENTS AND FUTURE PARTNERS." John T. Livingston, chief executive, AECOM Capital



Alternative financing for existing buildings

Alternative financing solutions are closing the economic gap on existing building refurbishments.

Energy Saving Performance Contracts (ESPC or EPC) deliver energy savings by upgrading inefficient functional or passive elements of a building. This procurement shift involves a client engaging a single service provider — an Energy Services Company (ESCO) — to scope, design, and install the solution, and then guarantee the forecast savings so the investment meets an agreed payback period.

Described as a "financial solution to a technical problem," ESPCs provide a mechanism to channel alternative sources of funding into a typically cash restricted project.

Although the basis of the EPC framework is a "spend-to-save" model, and that the headline message is one of energy and carbon savings, the reality is that such savings are often enabling other more important outcomes for property managers. From an asset management perspective, the real attraction of an EPC is that it provides a powerful mechanism to respond to the issue of ageing assets.

Almost invariably across the public sector, a legacy of under investment in asset replacements has led to a substantial asset management headache, which under "business-as-usual" procurement models would take many years to rectify. ESPCs simplify the process by providing a framework that allows several small asset replacement works to be bundled into one larger contract which engages larger market players. Despite the opportunities that ESPCs present, public funding remains an issue. With limitations on government agencies securing debt, the market has sought a means to replace public funding with private finance.



ESPC transfer of savings

"MOST IMPORTANTLY, FINANCING AN ESPC PROJECT CAN PRESERVE CAPITAL TO INVEST IN THE ORGANIZATION'S CORE MISSION." Darcy Immerman, senior vice president,

energy, AECOM

Cash flow analysis indicates that the financial return — without considering opportunity cost — is higher when multiple projects can be implemented compared to reliance on a sinking fund with staggered projects over a number of years. ESPC removes the capital barriers to achieving these returns.

Collaborative delivery

Alternative collaborative delivery mechanisms, such as Integrated Project Delivery, are growing in favor.

Early involvement of all key participants and stakeholders will ensure a project has the right procurement approach from its inception.

Consideration of alternative financing may require a rethink of how a project is structured. Pension funds represent an enormous source of potential capital to fund social and civil infrastructure projects. However, given the long-term investment strategy of pension funds, there has been a misalignment in values between the shorter term aims of traditional project delivery. Pension funds interest extends well beyond the construction delivery phase and typically decades into ownership. Therefore, active participation of the future owner/operator is critical in the early procurement, concept, design and construction stages to reduce the lifecycle risk of the asset.

Pension funds have cited this as a barrier to entry in the past, however, with interest growing in alternative, collaborative procurement models there is a means to address this disconnect.



MARKET TRENDS + COST BENCHMARKS

- 46 GLOBAL TRENDS
- 56 AFRICA
- 64 ASIA
- 72 AUSTRALASIA
- 80 EUROPE
- 88 MIDDLE EAST
- 96 NORTH AMERICA

How are global markets comparing?

Europe

London: Improving sentiment is driving a gradual return to construction cost escalation albeit with competitive prices remaining for the time being.

Ireland: 2013 marked a notable turning point in the market with positive industry employment, foreign investment and improved market fundamentals leading to new viable projects coming to market.

Africa

Johannesburg: South Africa has been experiencing significant cost escalation across the broader economy and the construction industry is no exception. Construction and utility costs continue to rise at a steady pace.

Middle East

United Arab Emirates: Industry performance in the Middle East remains mixed. Despite large spending plans, project decision making and financing are leading to substantial delays in projects transitioning to build phase. This has resulted in contained construction costs.

Asia

Hong Kong: Costs have escalated by 65 percent since 2009. Hong Kong experienced the shortest downturn and has outpaced escalation seen in other markets.

Singapore: Construction prices fell 20 percent from 2008 and remained steady for three years. Recent expansion has seen a return to construction cost escalation. Hong Kong

Johannesburg

United States

Sydney

Auckland

2008

Australasia

Sydney: Increasing input costs (materials and labor) were offset by tighter margins, which has led to most cities in Australia experiencing relatively stagnant cost escalation since 2008.

Auckland: New Zealand's broad economic expansion, earthquake rebuild work in Christchurch and rising housing demand are driving escalating construction prices.

North America

United States: The recovery in the construction market is being led by investment in the housing market and to a lesser degree the commercial sector.

Canada: The impact of an ageing construction workforce and skill limitations are creating some challenges associated with a patchy project pipeline, calling for greater labor mobility. Kuala Lumpur

Singapore

Ireland U.A.E.

London

Chart: Indicates relative movement in construction prices from 2008 to 2014.

Source: Based on AECOM Indices for Australia, Ireland, London, New Zealand, United Arab Emirates (U.A.E.), United States (multicity index) and Malaysia Construction Industry Development Board (CIDB), Singapore Building Construction Authority (BCA), Hong Kong Building Works Tender Price Index (BWTPI), Johannesburg Bureau of Economic Research (BER).

Residential

Augusta susliku kiskurias	Average quality high-rise	Luxury high-rise
Average quality high-fise	USD/m ²	USD/m ²
New York	4,320	5,290
San Fran	icisco 4,300	5,200
Los Ange	eles 4,100	5,020
Toronto	3,510	4,240
Paris	3,190	4,440
London	2,900	3,900
Singapor	re 2,660	3,570
Sydney	2,530	2,910
Hong Ko	ng 2,360	3,060
Auckland	2,320	2,630
Doha	1,580	2,150
Riyadh	1,580	1,890
Moscow	1,500	2,000
Dubai	1,360	1,800
Bahrain	1,300	1,600
Beijing	1,210	1,530
Johanne	sburg 895	1,550
Istanbul	850	1,680
Bangkok	795	1,065
Ho Chi M	linh 715	860
Mumbai	325	430

Relative building costs based on Q2 2014. Cities ordered by average quality residential high-rise. Source: AECOM

Commercial

Average quality office high-rise		Average quality office high-rise	Prestige office high-rise	Major shopping center
		USD/m ²	US	D/m ²
	New York	4,590	5,180	3,620
	San Francisco	4,550	5,150	3,600
	Los Angeles	4,160	4,860	3,130
	Toronto	3,710	4,200	2,940
	Paris	3,330	4,440	4,860
	London	3,090	3,900	5,530
	Sydney	2,810	3,190	2,250
	Auckland	2,720	3,180	2,400
	Hong Kong	2,440	3,140	3,550
	Singapore	2,420	3,130	3,330
	Moscow	2,000	2,500	1,500
	Doha	1,850	2,100	1,250
	Dubai	1,600	1,850	1,400
	Riyadh	1,580	2,100	1,370
	Johannesburg	1,180	1,510	1,170
	Bahrain	1,170	1,280	1,230
	Istanbul	1,150	1,760	1,350
	Beijing	1,120	1,560	1,510
	Ho Chi Minh	855	1,270	820
	Bangkok	805	1,035	920
	Mumbai	370	410	485

Relative building costs based on Q2 2014. Cities ordered by average quality office high-rise. Source: AECOM

GLOBAL TRENDS — OFFICE LEASING

Office leasing comparison — Prime A-Grade gross face rent per annum



Tourism

	ve-star xury otel	nree-sta udget otel	esort yle otel
Five-star luxury hotel	ii 2 ž	<u>ة ة ج</u>	
	USD/m ²		USD/m²
Paris	6,530	3,060	3,470
New Yor	k 5,430	2,590	5,400
San Fran	ncisco 5,290	2,540	5,400
London	5,220	2,610	2,970
Los Ange	eles 5,180	2,430	5,290
Hong Ko	ng 4,540	3,340	
Singapo	re 4,440	2,900	4,210
Toronto	4,310	2,070	4,400
Aucklan	d 4,110	2,990	3,750
Sydney	4,030	2,910	3,660
Istanbul	3,800	1,870	1,750
Moscow	3,500	2,200	2,700
Doha	3,500	2,100	3,950
Dubai	3,000	2,150	3,600
Riyadh	2,780	1,790	3,360
Bahrain	2,620	1,800	3,200
Johanne	sburg 2,370	1,795	2,840
Beijing	2,360	1,150	2,960
Bangkok	1,615	860	1,555
Ho Chi M	1inh 1,375	775	1,300
Mumbai	1,035	625	1,190

Relative building costs based on Q2 2014. Cities ordered by five-star luxury hotel. Source: AECOM

Industrial

		ht tory	avy tory
		dut fac	He dut fac
Light duty factory		USD/m ²	USD/m ²
	Singapore	1,790	
	Hong Kong	1,670	
	Paris	1,670	2,500
	New York	1,650	2,160
	San Francisco	1,620	2,130
	London	1,580	2,610
	Los Angeles	1,350	1,840
	Toronto	1,320	1,740
	Moscow	1,000	1,900
	Doha	990	1,150
	Istanbul	750	1,900
	Riyadh	740	950
	Dubai	630	930
	Bahrain	620	700
	Sydney	610	770
	Auckland	600	760
	Beijing	570	
	Mumbai	535	
	Bangkok	460	
	Johannesburg	405	565
	Ho Chi Minh	390	

Relative building costs based on Q2 2014. Cities ordered by light duty factory. Source: AECOM

global Unite

AECOM has developed Global Unite, its own international benchmarking and project performance knowledge system.

The intelligence which we have gathered from our involvement in thousands of projects greatly assists us benchmark project costs and design efficiencies when establishing construction cost estimates for proposed projects.

In this era of data on demand, it has become increasingly important to be able to deliver insight that is evidence-based, data-backed, and rapidly delivered. Instead of relying on locally stored and siloed sources of cost and benchmarking data, our quantity surveyors and construction cost managers can access a vast and growing pool of data generated from real projects which can be applied to guide new projects.

We can now instantly analyze parameters that define how effective or efficient an asset is (or is not) against local or global standards for all asset types.

Unrivaled design and cost knowledge in the market in one system A system gathering a wealth of previously untapped data. Captures data at source from estimating, BIM and CAD systems

global

Database of elemental cost data, project information and key benchmark ratios. Invaluable bank of knowledge to inform decision making on new projects

Sector/market information, design drivers, plus cost, functional and ancillary information

AECOM's Global Unite is powered by UniPhi

Global Unite helps us to improve the way projects are delivered in the following ways:

- Delivering unparalleled access to quality global and local knowledge that adds value to projects.
- Allowing us to assess best practice and how the project compares by direct comparison of a project with global data.
- Providing the ability to collect and share project performance data from across the whole of AECOM globally.
- Automatically gathering an extensive wealth of project knowledge as we complete our daily activities without the need for manual data capture.
- Taking knowledge from our estimating and measurement systems and applies data mapping rules to manage differences in geographic definitions.
- Capturing data at source and thereby allowing us to deliver local and global knowledge in a consistent and managed way.



A truly global project database must consider the regional nuances that define local markets.

Each region in AECOM's Global Unite network has subtle variations that reflect the elemental breakdown structure to ensure the capture of cost and quantity data is appropriate for local projects and comparable for international benchmarking.

Although construction cost information is specific to a particular location, design benchmarks can be extracted and analyzed for the benefit of driving efficiency across differing project types globally. As an example, the ability to compare the efficiency of a "façade-to-floor ratio" on an office tower can be applied no matter whether you are in New York, London or Sydney. This information can then be used to assist the client in creating efficient and cost effective outcomes.

Global Unite is available to clients wanting to benchmark their own projects.

For clients who have large capital programs or who undertake numerous construction projects, AECOM can provide Global Unite as a service whereby we can create a tailored solution that will capture and manage their data and configure specific benchmarks and reports that add value to their decision-making processes.

Global cost and design benchmarking network



Global Unite is available as a web and tablet app for both iOS and Android.

Using GUIDE (Global Unite Indicative Design Estimator), AECOM can quickly and easily create early construction cost advice for clients who are considering new projects. GUIDE draws on the database of project information contained in Global Unite and provides construction cost advice based on similar projects.

The parametric model can be used to create a construction cost model relevant to the client's latest project. By adjusting elements such as floor area or other key benchmarks including functional units, a comparison against world's best practice can be assessed. The GUIDE app provides the ability to access the benchmark cost and design information reports that exist in Global Unite but in a mobile format. This means that it can be used in the office, at external meetings, clients' offices or anywhere with an internet connection that can connect to the extensive database.

"FOR AN ARCHITECT WORKING INTERNATIONALLY WITH GLOBAL CLIENTS, THE NEED TO PROVIDE CROSS-BORDER BENCHMARKING HAS NEVER BEEN MORE IMPORTANT. GLOBAL UNITE PROVIDES COMPETITIVE ADVANTAGES BY PUTTING THE WORLD AT YOUR FINGERTIPS." Peter Oborn, RIBA vice president international





Soccer City Johannesburg, South Africa

Image: Boogertman Urban Edge and Partners in partnership with Populous Ser. 1

MARKET TRENDS

Several African countries — both the resource-rich and the non-resource rich — are among the fastest growing countries in the world. According to the International Monetary Fund (IMF) the Sub-Saharan region is expected to maintain a growth rate of more than five percent over the next six years. In 2012, the region's GDP was US\$1.3 trillion in 2012, compared to US\$12 trillion in emerging Asia.

Countries such as Côte d'Ivoire, Ghana, Rwanda and Uganda should see a boost from higher agricultural export prices, while moderation in commodities such as iron ore will affect countries such as the Democratic Republic of the Congo, Guinea, Liberia, and Zambia. Growth in South Africa is expected to be hampered by ongoing electricity constraints and labor market issues.



Recent global growth and forecasts

Real GDP growth, 2013



Gross domestic product (GDP), percent change in constant prices, 2012 GDP value in current prices. Source: IMF South Africa's building industry has also been affected by rising costs which are stalling growth and business sentiment, as reflected in The First National Bank and Bureau for Economic Research (BER) Building Confidence Index.

The Sub-Saharan commercial property sector remains under pressure, although some sectors, such as retail, have been buoyed by increasing interest from multinational investors in South Africa, as well as other African countries.

The fast-growing economies of Kenya, Nigeria and Ghana were among the top five improvers in Jones Lang LaSalle and LaSalle Investment Management's Global Real Estate Transparency 2014 report. These countries have improved regulatory frameworks and continue to attract international corporates seeking regional hubs for operations in East and West Africa. The African Union's vision of structural transformation of trade, strengthening of Africa's infrastructure and human resources, and economic diversification is addressed in the African Centre for Transformation's 2014 report. It outlines how Africa can boost its competitiveness and mirror the success of earlier transformations in Asia and Latin America by strengthening the following sectors:

- labor-intensive manufacturing
- agro-processing
- oil, gas, and mineral resources
- leisure and business tourism.

This would increase exports, allocate labor to the most productive sector (and capitalize on rising wages in countries such as China), boost local food supplies and help attract further foreign investment. This local economic direction is expected to guide future building and infrastructure development across much of the continent.



Global real estate transparency index - top improvers, 2012-2014

Source: Jones Lang LaSalle and LaSalle Investment Management



AFRICA — RELATIVE COST OF CONSTRUCTION

Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects. Relative costs are based on an average across all sectors.



AFRICA — BUILDING COSTS

	esburg	u M								Salaam	Ø	
	Johanne	Cape To	Durban	Luanda	Accra	Nairobi	Abuja	Kigali	Dakar	Dar es S	Kampal	Lusaka
		ZAR/m	1 ²				ι	JSD/m ²	2			
Residential												
RDP housing	1,800	2,070	1,980	290	155	155	205	220	195	180	170	175
Low cost housing	3,900	4,485	4,290	625	340	340	440	480	420	390	370	375
Simple low-rise apartment block	7,900	9,085	8,690	1,260	690	680	900	980	850	790	750	760
Economic duplex townhouse	8,100	9,315	8,910	1,295	705	700	920	1,000	875	805	770	780
Prestige apartment block	16,800	19,320	18,480	2,690	1,470	1,460	1,900	2,070	1,820	1,670	1,600	1,620
Economic private dwelling	4,100	4,715	4,510	655	360	355	465	505	445	410	390	395
Standard private dwelling	5,600	6,440	6,160	895	490	485	635	690	605	555	535	540
Middle class private dwelling	6,500	7,475	7,150	1,040	570	560	740	800	700	650	620	630
Luxury private dwelling	9,400	10,810	10,340	1,505	820	815	1,065	1,160	1,015	935	895	905
Exclusive private dwelling	14,000	16,100	15,400	2,240	1,220	1,215	1,585	1,730	1,515	1,390	1,330	1,350
Exclusive super luxury private dwelling	43,100	49,570	47,410	6,900	3,760	3,730	4,880	5,320	4,660	4,280	4,100	4,150
Outbuildings	4,100	4,715	4,510	655	360	355	465	505	445	410	390	395
Studios												
Dancing, art, exhibitions, etc,	15,300	17,600	16,830	2,450	1,335	1,325	1,735	1,890	1,655	1,520	1,455	1,475
Extra amenity (per unit)												
Swimming pool (<50kl)	3,500	4,025	3,850	560	305	305	395	430	380	350	335	335
Swimming pool (<100kl)	6,700	7,705	7,370	1,075	585	580	760	825	725	665	635	645
Standard tennis court	5,500	6,325	6,050	880	480	475	625	680	595	545	525	530
Flood lit tennis court	10,000	11,500	11,000	1,600	875	865	1,135	1,235	1,080	995	950	965
Carports												
Single shaded carport	280	322	308	45	24	24	32	34	30	28	27	27
Double shaded carport	268	308	295	43	23	23	30	33	29	27	25	26
Single covered parking	440	506	484	70	38	38	50	54	48	44	42	42
Double covered parking	400	460	440	64	35	35	45	49	43	40	38	39
Hotel (per key)												
Three-star/budget*	929,800	1,069,300	1,022,800	148,840	81,170	80,540	105,360	114,750	100,530	92,430	88,450	89,560
Four-star/mid scale*	1,644,600	1,891,300	1,809,100	263,300	143,600	142,500	186,400	203,000	177,800	163,500	156,400	158,400
Five-star/luxury*	2,909,300	3,345,700	3,200,200	465,700	254,000	252,000	329,700	359,100	314,500	289,200	276,800	280,200

Base date for all costs = Q2 2014

1 ZAR = 0.093 USD

Inclusive of builder's preliminaries & profit but exclusive of site works, external services, land and interest costs.

Costs exclude VAT and escalation.

*Excluding FF&E

AFRICA — BUILDING COSTS

	annesburg	e Town	an	br	ŋ	obi	a.	ili	ar	es Salaam	ıpala	aka
	Joha	Cap	Durt	Luai	Accı	Nair	Abu	Kiga	Dak	Dar	Karr	Lus
		ZAR/m ²	:				U	SD/m ²				
Conference centres												
International standard center	24,900	28,640	27,390	3,990	2,170	2,160	2,820	3,070	2,690	2,480	2,370	2,400
Retirement centres												
Middle class dwelling	6,300	7,245	6,930	1,010	550	545	715	780	680	625	600	605
Luxury dwelling	8,900	10,235	9,790	1,425	775	770	1,010	1,100	960	885	845	855
Middle class apartment block	6,500	7,475	7,150	1,040	565	565	735	800	705	645	620	625
Luxury apartment block	10,200	11,730	11,220	1,635	890	885	1,155	1,260	1,105	1,015	970	980
Middle class community center	8,600	9,890	9,460	1,375	750	745	975	1,060	930	855	820	830
Luxury community center	12,600	14,490	13,860	2,015	1,100	1,090	1,430	1,555	1,360	1,255	1,200	1,215
Offices												
Low-rise office – standard	7,600	8,740	8,360	1,215	665	660	860	940	820	755	725	730
Low-rise office – prestigious	12,000	13,800	13,200	1,920	1,050	1,040	1,360	1,480	1,295	1,195	1,140	1,155
High-rise tower block – standard	12,000	13,800	13,200	1,920	1,050	1,040	1,360	1,480	1,295	1,195	1,140	1,155
High-rise tower block – prestigious	15,000	17,250	16,500	2,400	1,310	1,300	1,700	1,850	1,620	1,490	1,425	1,445
Parking												
Parking on grade, including landscaping	540	620	595	86	47	47	61	67	58	54	51	52
Structured parking	3,000	3,450	3,300	690	375	370	485	530	465	425	410	415
Parking in semi basement	4,500	5,175	4,950	720	395	390	510	555	485	445	430	435
Parking in basement	5,500	6,325	6,050	880	480	475	625	680	595	545	525	530
Retail												
District center	8,500	9,775	9,350	1,360	740	735	965	1,050	920	845	810	820
Regional center	11,600	13,340	12,760	1,855	1,015	1,005	1,315	1,430	1,255	1,155	1,105	1,115
Strip shopping	9,300	10,695	10,230	1,490	810	805	1,055	1,150	1,005	925	885	895
Education												
Primary schools	5,850	6,850	6,500	1,185	645	640	840	915	800	735	705	715
Secondary schools	6,450	7,600	7,200	1,315	715	710	930	1,010	885	815	780	790

AFRICA — MAJOR UNIT RATES

		Johannesburg	Cape Town	Durban	Luanda	Accra	Nairobi	Abuja	Kigali	Dakar	Dar es Salaam	Kampala
	UNIT		ZAR					USI)			
Basement excavation	m³	88	101	96	14	8	8	10	11	9	9	8
Foundation excavation	m³	131	151	145	21	11	11	15	16	14	13	12
Imported structural fill	m³	294	338	324	47	26	25	33	36	32	29	28
Concrete in pad footing (25Mpa)	m³	1,315	1,515	1,450	210	115	115	150	165	140	130	125
Concrete in wall (32Mpa)	m³	1,175	1,355	1,295	190	105	100	135	145	125	115	110
Concrete in suspended slab (32Mpa)	M3	1,235	1,420	1,355	195	110	105	140	150	135	125	115
Formwork to slab soffit	m²	131	151	145	21	11	11	15	16	14	13	12
Formwork to side and soffit of beam	M²	289	332	318	46	25	25	33	36	31	29	27
Precast wall panel architectural with sand blast finish	M2	825	950	910	130	70	70	95	100	90	80	80
Reinforcement in beam	t	10,450	12,010	11,490	1,670	910	900	1,180	1,290	1,130	1,040	990
Structural steel in beam	t	30,490	35,060	33,540	4,880	2,660	2,640	3,450	3,760	3,300	3,030	2,900
Structural steel in truss	t	30,290	34,840	33,320	4,850	2,640	2,620	3,430	3,740	3,280	3,010	2,880
Aluminium framed window 6.5mm clear glass	M2	3,150	3,620	3,465	505	275	275	355	390	340	315	300
Aluminium panel curtain wall system (including structural system)	M2	3,640	4,185	4,005	585	320	315	415	450	395	360	345
Steel stud partition (framing)	M2	104	120	115	17	9	9	12	13	11	10	10
Plasterboard 13mm thick to partition	M²	52	60	57	8	5	5	6	6	6	5	5
Suspended mineral fiber ceiling tile	M²	167	192	184	27	15	14	19	21	18	17	16
Paint on plasterboard wall	m²	37	42	40	6	3	3	4	5	4	4	4
Ceramic tiles to wall	m²	520	598	572	83	45	45	59	64	56	52	49
Non-slip vinyl to wet areas	m²	347	399	382	56	30	30	39	43	38	34	33
Anti static carpet tile to office and admin areas	M2	472	543	520	76	41	41	54	58	51	47	45
Anti static broadloom carpet to office and admin areas	M2	1,299	1,494	1,429	208	113	113	147	160	140	129	124
Aluminium framed shopfront	M2	2,265	2,605	2,490	360	200	195	255	280	245	225	215

1 ZAR = 0.093 USD

AFRICA — CONSTRUCTION COST INDEX



	Johannesburg
Q2 2008	147.0
Q3 2008	141.2
Q4 2008	157.5
Q1 2009	138.7
Q2 2009	151.0
Q3 2009	140.9
Q4 2009	145.6
Q1 2010	145.7
Q2 2010	144.8
Q3 2010	142.0
Q4 2010	142.4
Q1 2011	140.8
Q2 2011	149.2
Q3 2011	147.8
Q4 2011	156.7
Q1 2012	153.3
Q2 2012	156.1
Q3 2012	161.4
Q4 2012	164.9
Q1 2013	170.0
Q2 2013	166.9
Q3 2013	171.2
Q4 2013	172.1
Q1 2014	175.7
Q2 2014	178.0
Q3 2014	182.7
Q4 2014	189.0

	Africa construction cost relativities
Johannesburg	100
Cape Town	115
Durban	110
Luanda	170
Accra	93
Nairobi	92
Abuja	120
Kigali	131
Dakar	115
Dar es Salaam	106
Kampala	101
Lusaka	102

Based on monthly forecasts.

Source: Bureau for Economic Research Building Cost Index



Singapore Sports Hub Singapore

MARKET TRENDS

Many economies in Asia are undergoing a considerable transformation and this is shaping activity in the buildings and infrastructure markets. AECOM's Asia Construction Outlook shows that while some parts of the region are slowing, others continue to strengthen.

While many countries will not see the double-digit growth rates of recent years, construction activity is still very high compared to many other parts of the world. Some of the busiest markets remain buoyant including China, India, Vietnam and Indonesia, while the Philippines and Myanmar are experiencing increasing activity.

The new political leadership in India will likely slow progress on some major infrastructure developments. However, as is the case for several countries in the region, India is also attracting more interest from foreign investors, which is expected to accelerate growth in the construction market.

Another contributor to growth in Asia's emerging nations is the rise of a more services-based and consumer driven economy. In China services as a proportion of GDP reached 45 percent in 2012, up from 41 percent a decade ago. In India, the value of the services industry contributes a greater share of GDP, at 56 percent (up from 53 percent), while in the Philippines it contributes 57 percent.

The development of these emerging economies is also reflected in the GDP per capita growth over the last decade. China's has more than tripled since 2002, while India and Vietnam's have more than doubled.



Last decade of economic development in Asia

Economic development represented by gross domestic product based on purchasing-power-parity, services economy is value added % GDP in 2012. Source: World Bank, IMF

One of the contributors to this growth is wages. In 2012, China's annual wage was US\$6,500, 30 percent more than Thailand and the Philippines, two to three times more than Vietnam and Indonesia and five to six times more than Cambodia. Following this, industries are likely to look beyond China to base lower-end manufacturing. Other emerging nations are expected to benefit from this industrial migration.

In turn China is expected to expand its focus on manufacturing higher up the value chain. The country's hightech export market has already rapidly escalated over the last decade. By 2005 it had surpassed the value of goods produced in Germany and Japan and by 2012 it was exporting over US\$500 billion annually. However, this market currently represents less than 25 percent of China's overall manufacturing exports. In contrast, high-tech exporting is already well entrenched in Singapore and Malaysia and constitutes a far greater proportion of their manufacturing exports (more than 43 percent); however, this has eased slightly compared to 2002 levels. Switzerland and France have also increased their level of high-tech exporting over the last decade.

In China's property market we have witnessed some easing, however infrastructure development remains strong. China has devised a "New Silk Roads" policy to enhance connectivity with neighboring countries, such as maritime links with ASEAN, and land links such as the east-west railway line which has been extended to Moscow and Germany. High speed rail has also proved to be a successful investment for the country.



Top high-tech exporting nations, change 2002-2012

High-tech exports are products with high R&D intensity, such as in aerospace, computers or science, shown as a proportion of manufactured exports.

Source: World Bank



ASIA — RELATIVE COST OF CONSTRUCTION

Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects.

Source: AECOM

ASIA — CONSTRUCTION COST INDICES

Change since 2008



Source: Adapted from Malaysia CIDB, Singapore BCA, Hong Kong BWTPI

ASIA — BUILDING COSTS

	ıanghai	ijing	ong Kong	ailand	i Lanka
	<u>5</u>	ă	Ĭ	두	ភ
	RMB/m ²	RMB/m ²	HKD/m ²	THB/m ²	LKR/m ²
Commercial					
Offices average standard, high-rise	6,800 - 7,800	5,900 - 7,800	17,400 - 20,400	23,850 - 28,350	110,000 - 140,000
Offices prestige standard, high-rise	8,000 - 10,000	8,200 - 11,000	21,900 - 26,800	30,000 - 37,200	150,000 - 180,000
Shopping centers average quality	6,000 - 7,800	6,200 - 7,800	19,900 - 23,300	20,500 - 22,800	110,000 -140,000
Shopping centers high quality	7,500 - 9,500	7,400 - 11,100	24,800 - 30,300	27,500 - 32,450	140,000 - 170,000
Hotel					
Three-star	6,500 -8,500	6,500 - 7,600	23,900 - 28,000	26,500 - 29,500	155,000 - 194,000
Four-star	9,500 - 11,500	8,200 - 11,000	28,100 - 32,700	37,000 - 42,000	194,000 - 220,000
Five-star	13,000 - 16,000	12,500 - 16,500	32,900 - 37,500	44,500 - 60,500	220,000 - 310,000
Resort hotels	15,000 - 18,000	15,600 - 20,800		36,000 - 65,000	220,000 - 310,000
Industrial					
Flatted factories	3,200 - 4,500	2,800 - 4,200	12,000 - 13,900	13,500 - 16,500	
Flatted warehouses	3,200 - 4,500	2,600 - 4,200	13,000 - 15,100	13,500 - 16,500	
Education					
Primary schools			17,000 - 18,700		
Secondary schools			17,600 - 20,200		
Residential					
Terraced houses	3,800 - 4,500	3,800 - 4,400	24,400 - 27,400	12,500 - 14,500	
Semi-detached houses	4,600 - 5,800	4,700 - 5,900	28,100 - 32,900	15,000 - 17,000	80,000 - 110,000
Detached houses/bungalows	4,600 - 6,000	4,800 - 6,300	31,600 - 38,700	19,500 - 27,500	100,000 - 130,000
Condominiums medium standard, high-rise	6,500 - 8,000	6,800 - 8,000	17,300 - 19,400	24,800 - 27,000	130,000 - 150,000
Condominiums luxury standard, high-rise	8,000 - 10,000	8,000 - 10,800	21,400 - 26,100	32,800 - 36,500	170,000 - 190,000
Service apartments	10,000 - 12,000	8,400 - 11,500	22,900 - 28,000	34,000 - 41,500	181,000 - 220,000
Low cost flats, high-rise	3,800 - 4,800		15,100 - 17,400	12,500 - 14,500	
Carparks					
Multi-storey/elevated carparks			8,200 - 9,100	9,500 - 12,500	60,000 - 70,000
Basement carparks	4,000 - 5,000	3,800 - 5,900	12,700 - 15,300	14,500 - 20,000	80,000 - 130,000
Infrastructure					
Road works			500 - 700*		
Drainage works			250 - 400		
	RMB	RMB	HKD	THB	LKR
USD =	6.14	6.14	7.76	32.50	130.72

Base date for all costs = Q2 2014

* Excluding lighting

ASIA — BUILDING COSTS

	Singapore^	West Malaysia	East Malaysia	India (Tier I Cities)	India (Tier II Cities)	Vietnam
	SGD/m ²	MYR/m ²	MYR/m ²	INR/m ²	INR/m ²	VND ('000)/m ²
Commercial						
Offices average standard, high-rise	3,000 - 4,100	2,450 - 3,500	2,400 - 3,450	21,000 - 24,500	19,000 - 21,000	16,700 - 19,390
Offices prestige standard, high-rise	4,100 - 5,000	3,700 - 5,150	3,500 - 4,950	23,000 - 27,500	21,000 - 26,500	24,500 - 28,970
Shopping centers average quality	3,100 - 4,100	2,700 - 3,500	2,400 - 3,450	19,000 - 24,500	18,000 - 23,500	12,870 - 15,840
Shopping centers high quality	4,100 - 5,400	3,800 - 5,500	3,250 - 4,850	25,000 - 35,000	24,000 - 35,000	15,840 - 18,810
Hotel						
Three-star	3,500 - 4,600	4,000 - 5,100	3,500 - 5,000	35,000 - 42,000	23,500 - 40,000	15,350 - 17,330
Four-star	4,600 - 5,600	5,000 - 6,000	4,500 - 5,550	50,000 - 58,000	50,500 - 58,000	21,770 - 24,680
Five-star	5,600 - 6,500	6,100 - 7,800	5,500 - 7,900	60,000 - 68,000	61,000 - 68,500	27,220 - 30,850
Resort hotels	5,000 - 6,500	4,500 - 6,200	4,600 - 7,350	68,000 - 79,000	68,500 - 79,000	20,720 - 34,130
Industrial						
Flatted factories	2,000 - 2,500	1,450 - 2,050	1,500 - 2,050	28,000 - 38,000	25,000 - 36,000	7,240 - 9,270
Flatted warehouses	2,000 - 2,500	1,600 - 2,050	1,500 - 2,050	19,000 - 21,000	17,000 - 20,000	7,650 - 9,770
Education						
Primary schools	1,500 - 1,800	1,000 - 1,350	1,350 - 1,700	14,000 - 17,000	12,500 - 15,000	
Secondary schools	1,800 - 2,200	1,000 - 1,500	1,400 - 1,800	14,000 - 22,000	12,500 - 15,000	
Residential						
Terraced houses	2,800 - 3,500	1,000 - 1,350	1,150 - 1,500			9,780 - 10,010
Semi-detached houses	3,500 - 4,500	1,400 - 2,000	1,500 - 2,350	18,000 - 19,000	16,000 - 17,000	11,900 - 12,900
Detached houses/bungalows	4,500 - 5,500	1,900 - 3,200	2,200 - 4,700	29,500 - 35,000	27,000 - 34,000	12,880 - 13,870
Condominiums medium standard, high-rise	3,200 - 4,500	1,500 - 2,100	1,750 - 2,450	19,000 - 21,000	16,000 - 18,000	13,630 - 16,610
Condominiums luxury standard, high-rise	4,500 - 5,800	2,500 - 3,500	2,450 - 3,550	25,000 - 28,000	22,000 - 26,000	17,420 - 18,840
Service apartments	3,500 - 4,500	2,900 - 4,000	2,700 - 4,200	44,000 - 60,500	30,000 - 40,000	15,150 - 20,210
Low cost flats, high-rise		1,000 - 1,200	1,300 - 1,650	15,400 - 16,500	13,000 - 14,000	7,730 - 8,920
Carparks						
Multi-storey/elevated carparks		1,000 - 1,450	1,050 - 1,350	9,450 - 12,100	9,000 - 11,000	6,350 - 8,120
Basement carparks		1,700 - 2,900	1,625 - 3,200	14,300 - 16,500	12,000 - 14,000	10,400 - 12,710
	SGD	MYR	MYR	INR	INR	VND
USD =	1.26	3.27	3.27	61.84	61.84	21,080

Construction costs for a variety of building types are given in unit area (square meter) of the built-up floor area of the building in the local currency and based on analysis of tender returns under competitive tendering conditions. The built-up floor area is the total area of covered enclosed floor space fulfilling the functional requirements of the building measured to the outside structural face of the external enclosing walls and excludes carparks (above and below ground).

^ Based on Gross Floor Area (GFA) which is defined as the total floor area of a building comprising all enclosed and covered spaces (excluding any carparks whether in basement and/or above ground) calculated for the purpose of planning submissions to approving authorities.

ASIA — MAJOR UNIT RATES

		langhai	ijing	ung Kong	dia er I Cities)	dia er II Cities)	alaysia	i Lanka	ngapore	ailand	etnam
		ත් RMB	ВМВ	т Т	É É INR	ĔĔ	Š MYR	م م	ซี ตออ	Ę 	Š
	UNIT	RIVID	I (IVIE)	TIKE	iiiiii	INT	IVITIX	LINIX	OUD	mb	('000)
Excavation; basement (up to 3.00m deep)	m³	48	35	140	350	350	28	600	35	280	134
Excavation; pad footings, pilecaps, trenches, ground beams etc. (up to 1.50m deep)	m ³	48	60	120	300	300	22	1,350	40	250	111
Vibrated reinforced concrete; Grade 30	m³	492	500	1,170	6,000	6,000	310	17,500	147	2,300	1,560
Reinforcement; high tensile/ mild steel rod	kg	4.80	6	10	63	63	3.90	180	1.60	32.00	24.50
BRC mesh reinforcement; Ref No. A7	m²			100	250	250	17	530	8.50		86
Sawn formwork; sides of vertical surfaces	m²	89	70	270	550	550	40	1,600	40	350	170
Brickwall; well burnt clay brick; half brick	m²	87		210	950	950	53	2,200	35	400	175
Metal roofing sheet; Colorbond; 0.65mm thick	m²		240	450	1,400	1,400	83	1,650	80	800	469
Glazed clay roof tiles, interlocking	m²	250	270	320	850	850	100	2,800	150	900	406
Timber flush door; single leaf; frame and ironmongery; 900 x 2100mm high	no	2,300	2,000	4,100	20,000	20,000	500	60,000	900	15,000	6,254
Fire-rated timber door; single leaf; 1 hr fire-rated; frame and ironmongery; 900 x 2100mm high	no	2,800	2,200	4,970	38,000	38,000	900	125,000	1,300	20,000	8,476
Wall partition; framing; gypsum board lining both sides; painting; 100mm thick	m²	238	240	650	2,500	2,500	105	8,000	75	800	400
Structural steelwork in roof trusses and purlins	kg	10	12	40	120	120	8.50	450	5	60	35
Aluminium casement windows; natural anodised; 6mm thick; clear float glass	m²	660	750	1,730	4,800	4,700	350	28,000	330	4,800	2,521
Plastering; cement and sand (1:3); wall; 12-20mm thick; internally	m²	34	29	100	375	375	30	850	20	240	72
Skim coat plastering; ceiling; 4-6mm thick	m²	29	22	60	250	250	9	520	9	120	50
Paving; cement and sand (1:3); floor; 20 -25mm thick	m²	40	38	90	350	350	20	3,625	20	300	63
Ceramic tiles; supply and lay to floor; 20mm thick cement and sand (1:3) screed	m²	210	240	450	1,500	1,500	85	5,800	80	1,100	536
Painting to plastered wall; one coat sealer and two coats emulsion paint; internally	m²	39	40	60	225	225	8	600	4	180	61
Average expected preliminaries	%	8 - 10%	6 - 8%	10 - 15%	12 - 15%	12 -14%	6 - 12%	6 - 10%	13 - 15%	10 - 15%	4 - 8%
ASIA — MATERIAL AND LABOR RATES

		Shanghai	Beijing	Hong Kong	India (Tier I Cities)	India (Tier II Cities)	Malaysia	Sri Lanka	Singapore	Thailand	Vietnam
	UNIT	RMB	RMB	HKD	INR	INR	MYR	LKR	SGD	THB	VND ('000)
Material											
Cement; ordinary Portland	tonne	420	410	750	6,000	6,000	358	14,300	120	3,000	1,527
Granite; coarse aggregate; 20mm	tonne	89	59	50	900	900	38	1,472	34	305	193
Sand; for concreting	m ³	140	94	90	1,800	1,800	55	3,500	33	360	157
Concrete; ready-mixed; Grade 30	m ³	405	395	810	4,800	4,500	230	13,500	115	2,000	1,163
Reinforcement; mild steel; 16 - 32mm dia	tonne	3,400	3,670	5,300	47,000	47,000	2,405	110,000	900	22,100	16,320
Reinforcement; high tensile; 16 - 32mm dia	tonne	3,440	3,470	5,300	48,000	48,000	2,348	110,000	900	20,900	16,670
Structural steel	tonne	4,000	6,800	5,600	55,000	55,000	4,900	160,000	1,350	41,000	22,500
Bricks; common	рс	0.50	1	4	7.00	6.00	0.50	12.00	0.25	1.60	1.28
Timber; hardwood; Chengal	ton	4,753	3,200	4,700			7,000		3,500		
Plywood; 12mm thick; 2400 x 1200mm	рс	93	113	2,900	1,750	1,750	65	3,200	25	500	435
Labor (Daily wage rates of con	struction	workers)									
General laborer	Day	180	130	710	400	400	75	1,000	110	520	266
Concretor	Day	220	200	1,260	550	550	100	1,500	115	600	320
Steel bar bender and fixer	Day	245	220	1,460	550	500	100	1,500	130	600	336
Brick/block layer	Day	250	240	1,000	600	550	100	1,500	120	600	366
Carpenter/joiner	Day	270	240	1,160	500	450	100	1,800	130	600	332
Plasterer/pavior	Day	252	230	1,090	500	450	110	1,500	135	600	364
Plumber	Day	205	160	1,020	500	450	105	1,800	130	680	364
Electrician	Day	235	160	830	500	450	110	1,800	140	720	364
Painter	Day	243	160	920	500	450	100	1,500	130	600	350
Welder	Day	260	180	1,060	600	550	100	1,500	145	680	376

AUSTRALASIA

Greater Curtin Master Plan Perth, Australia

MARKET TRENDS

The Australian economy is in transition: shifting from a mining base towards growth from a broader range of industries.

There are signs of business investment turning. However, consumer sentiment remains affected by concerns about further contraction in the labor market.

Government infrastructure plans and new dwellings are contributing to growth in the Australian construction market. Many new commercial projects have been slow to come to market, and some states are faring better than others. In some ways, it is a return of the two-speed economy but in reverse: those regions that were seeing an increase in demand from the mining and resources sector have now dropped down a gear or two.

The Australian property market continues to attract foreign investors looking to diversify their portfolios away from local markets, such as the troubled real estate sector in China.



Foreign investment interest in Australia

Source: Foreign Investment Review Board, approvals value

The United States (US), United Kingdom (UK) and Australia have been popular targets for investors from Singapore, China, and South Korea, as they seek better yields and more transparent property markets. Foreign investment interest in Australian property has more than doubled since 2009, with investors increasingly targeting the commercial sector.

US\$b 35 I 30 20 15 10 5 0 2010 2012 2013 201 United Kingdom United States Australia Italy France Germany

Asian real estate investment trends, selected countries

Source: Real Capital Analytics, Colliers International

Global house prices, 2013



In New Zealand, GDP has grown at above trend pace over the last year, fueled by strong export growth, infrastructure works and the Canterbury rebuild.

AECOM's New Zealand Construction Sentiment Survey registered rising confidence across most regions, with 56 percent of respondents in the May 2014 survey expecting an increase in spending, up from 42 percent in November 2013. This outlook has been strengthened by government commitments to an ambitious infrastructure pipeline and the considerable amount of work yet to be done as part of the rebuild in Canterbury.

The housing market has also been strong with price rises in Auckland and Christchurch contributing to a national rise of more than nine percent, pushing New Zealand close to the top of the list for global house price growth in 2013. In Australia, house prices rose by more than six percent in the same period.

New Zealand building work outlook



Net buildings market workload expectations. Source: AECOM New Zealand Sentiment Survey

Annual increase to Q4 2013. Source: OECD, Global Property Guide, Haver, IMF



AUSTRALASIA — RELATIVE COST OF CONSTRUCTION

Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects. Relative costs are based on an average across all sectors.



AUSTRALASIA — BUILDING COSTS

	Adelaide	Brisbane	Cairns	Canberra	Darwin	Melbourne	Perth	Sydney	Townsville	Auckland	Wellington	Christchurch
					AUD / I	m²					NZD /	m²
Residential												
Low-rise – multi unit	1,940	1,920	1,960	2,020	2,390	2,040	2,020	2,080	2,070	2,075	2,200	2,420
Low-rise – high quality	2,760	2,730	2,790	2,880	3,400	2,910	2,880	2,970	2,950	3,085	3,200	3,520
High-rise – medium quality	2,620	2,590	2,640	2,730	3,220	2,750	2,730	2,810	2,800	2,765	3,000	3,300
High-rise – high quality	3,000	2,970	3,040	3,130	3,700	3,160	3,130	3,230	3,210	3,135	3,500	3,850
Podium car parking	825	815	830	860	1,015	865	860	885	880	960	970	1,065
Basement car parking	1,335	1,325	1,350	1,395	1,645	1,410	1,395	1,435	1,430	1,570	1,500	1,650
Commercial												
Average standard offices												
- Low-rise	2,130	2,110	2,150	2,220	2,630	2,240	2,220	2,290	2,280	2,650	2,450	2,695
- Medium-rise	2,520	2,490	2,550	2,630	3,100	2,650	2,630	2,710	2,690	2,950	2,900	3,190
- High-rise	2,910	2,880	2,940	3,030	3,580	3,060	3,300	3,120	3,110	3,240	3,300	3,630
High standard offices	3,290	3,260	3,330	3,430	4,060	3,470	3,600	3,540	3,520	3,785	3,800	4,180
Industrial												
Light duty industrial	630	625	635	655	775	665	655	675	675	715	720	790
Heavy duty industrial	795	785	805	830	980	835	850	855	850	900	940	1,035
Attached offices	2,080	2,060	2,110	2,170	2,570	2,190	2,170	2,240	2,230	2,365	2,400	2,640
Hotel *Incl. FF&E												
Resort	3,780	3,740	3,820	3,940	4,650	3,980	3,940	4,060	4,040	4,465	4,300	4,730
Three-star budget*	3,000	2,970	3,040	3,130	3,700	3,160	3,130	3,230	3,210	3,560	3,500	3,850
Five-star/luxury*	4,170	4,120	4,210	4,340	5,130	4,390	4,340	4,470	4,450	4,890	4,800	5,280
Suburban motel*	2,330	2,300	2,350	2,420	2,860	2,450	2,420	2,500	2,480	2,715	2,700	2,970
Health												
District medical center	3,100	3,070	3,130	3,230	3,820	3,260	3,230	3,330	3,310	3,480	3,800	4,180
District hospital	3,730	3,690	3,770	3,890	4,590	3,930	3,890	4,010	3,990	3,990	4,300	4,730
Nursing home – including a/c	2,570	2,540	2,590	2,680	3,160	2,700	2,680	2,760	2,740	2,710	3,400	3,740
Retail												
District center	1,745	1,725	1,765	1,820	2,150	1,835	1,820	1,875	1,865	2,275	2,000	2,200
Regional center	2,325	2,300	2,350	2,425	2,865	2,450	2,425	2,495	2,485	2,860	2,700	2,970
Strip shopping	1,445	1,430	1,460	1,505	1,780	1,520	1,505	1,550	1,545	1,680	1,700	1,870
Education												
Primary schools	1,435	1,420	1,450	1,495	1,765	1,510	1,495	1,540	1,530	2,210	2,400	2,500
Secondary schools	1,695	1,680	1,715	1,765	2,090	1,785	1,765	1,820	1,810	2,460	2,800	3,000

Base date for all costs = Q2 2014

1 AUD = 0.90 USD

1 NZD = 0.84 USD

Inclusive of builder's preliminaries & profit but exclusive of site works, external services, land and interest costs.

*Including FF&E

AUSTRALASIA — MAJOR UNIT RATES

		aide	bane	S	Jerra	vin	ourne	ء	ley	Isville	kland	ington	stchurch
		Adel	Bris	Cair	Canl	Darv	Melk	Pert	Sydr	Томі	Auch	Well	Chri
	UNIT					AUD)					NZ)
Basement excavation	m³	43	42	43	45	53	45	45	46	46	58	60	65
Foundation excavation	m³	81	80	82	84	99	85	84	87	86	90	97	100
Imported structural fill	m³	90	89	91	94	111	95	85	97	96	101	95	75
Concrete in pad footing (25Mpa)	т³	240	235	240	250	295	250	250	255	255	295	320	340
Concrete in wall (32Mpa)	т³	315	310	315	325	385	330	325	335	335	350	350	395
Concrete in suspended slab (32Mpa)	т³	275	275	280	285	340	290	285	295	295	310	300	350
Formwork to slab soffit	m²	124	122	125	129	152	130	129	133	132	180	170	175
Formwork to side and soffit of beam	m²	138	136	139	144	170	145	144	148	147	154	145	200
Precast wall panel architectural with sand blast finish	M2	410	405	415	425	505	430	425	440	435	445	425	550
Reinforcement in beam	t	2,520	2,490	2,540	2,620	3,100	2,800	2,400	2,700	2,690	3,180	3,400	3,500
Structural steel in beam	t	6,180	6,110	6,240	6,440	7,610	6,500	6,440	6,630	6,600	6,370	7,000	6,500
Structural steel in truss	t	6,560	6,490	6,620	6,830	8,070	6,900	6,830	7,040	7,000	7,960	7,800	7,500
Aluminium framed window 6.5mm clear glass	m²	620	610	625	645	760	650	645	665	660	690	650	650
Aluminium panel curtain wall system (including structural system)	M2	855	845	865	890	1,055	900	890	920	915	960	1,000	950
Steel stud partition (framing)	m²	38	38	38	40	47	40	40	41	41	48	50	50
Plasterboard 13mm thick to partition	m²	29	28	29	30	35	30	30	31	30	35	35	40
Suspended mineral fiber ceiling tile	m²	57	56	58	59	70	60	59	61	61	64	70	40
Paint on plasterboard wall	m²	10	9	10	10	12	10	10	10	10	13	15	25
Ceramic tiles to wall	m²	86	85	86	89	105	90	89	92	91	111	110	150
Non-slip vinyl to wet areas	m²	71	71	72	74	88	75	74	77	76	90	90	90
Anti static carpet tile to office and admin areas	m²	57	56	58	59	70	60	59	61	61	69	65	80
Anti static broadloom carpet to office and admin areas	M2	55	55	56	57	68	58	57	59	59	58	55	70
Aluminium framed shopfront	m²	570	565	575	595	700	600	595	610	610	660	750	750

1 AUD = 0.90 USD

1 NZD = 0.84 USD

Rates are subcontract rates inclusive of labor and material fixed in position complete and include competitive margins for overhead and profit; are for projects constructed in the CBD area of average specification and of medium/high-rise construction.

The rates are net of GST component.

The rates are not intended to be used for tendering and/or the assessment of variations.

The rates are net of preliminaries.

AUSTRALASIAN CONSTRUCTION COST INDICES





	Adelaide	Brisbane	Cairns	Canberra	Jarwin	Melbourne	berth	Sydney	Townsville
Q1 2008	175	187	175	180	179	191	206	182	201
Q2 2008	178	191	178	183	191	194	211	185	211
Q3 2008	177	191	180	187	194	195	215	189	213
Q4 2008	176	191	180	185	198	190	214	186	212
Q1 2009	177	182	177	183	201	185	206	186	209
Q2 2009	177	180	174	179	202	185	204	186	205
Q3 2009	177	178	171	178	204	185	200	186	202
Q4 2009	177	176	170	179	207	182	196	186	201
Q1 2010	177	176	168	180	209	182	195	186	200
Q2 2010	177	177	168	182	212	184	194	187	200
Q3 2010	178	177	168	183	215	187	194	188	199
Q4 2010	178	177	168	184	216	191	193	188	199
Q1 2011	178	177	168	187	217	192	193	190	199
Q2 2011	178	177	168	187	219	193	193	190	200
Q3 2011	177	177	167	187	220	194	193	191	200
Q4 2011	177	177	169	188	222	194	193	191	201
Q1 2012	176	177	170	188	223	194	193	192	201
Q2 2012	176	177	170	188	225	194	193	192	201
Q3 2012	175	177	170	188	226	194	193	192	201
Q4 2012	176	177	170	190	227	194	193	193	199
Q1 2013	176	176	170	191	228	194	193	193	199
Q2 2013	176	176	170	191	229	194	193	194	199
Q3 2013	175	176	171	191	229	194	193	195	199
Q4 2013	175	177	171	191	230	194	193	196	199
Q1 2014	175	177	172	191	230	194	192	197	198
Q2 2014	175	178	172	191	231	194	192	198	198
Q3 2014	177	179	172	192	232	195	193	200	198
Q4 2014	178	180	174	192	233	196	193	202	199
Q1 2015	180	181	175	192	233	197	194	204	200

AUSTRALASIAN CONSTRUCTION COST INDICES



	Vew Zealand		Vew Zealand
01 2008	1 363	03 2012	1 354
02 2008	1 371	04 2012	1.358
03 2008	1,393	01 2013	1,365
04 2008	1,390	02 2013	1.372
Q1 2009	1,384	Q3 2013	1,383
Q2 2009	1.369	Q4 2013	1.397
Q3 2009	1.350	Q1 2014	1.411
Q4 2009	1.337	Q2 2014	1.426
Q1 2010	1.336	Q3 2014	1.443
Q2 2010	1,336	Q4 2014	1,460
Q3 2010	1,336	Q1 2015	1,479
Q4 2010	1,333	Q2 2015	1,499
Q1 2011	1,334	Q3 2015	1,519
Q2 2011	1,342	Q4 2015	1,538
Q3 2011	1,347	Q1 2016	1,557
Q4 2011	1,349	Q2 2016	1,574
Q1 2012	1,351	Q3 2016	1,590
Q2 2012	1,352	Q4 2016	1,605

Source: Statistics NZ, NZIER forecasts



The Shard London, United Kingdom

MARKET TRENDS

Recovery was tentative across most European economies during 2014.

The United Kingdom made progress with a lift in business and consumer confidence, and some investment recovery. The European Central Bank continued its efforts to stimulate activity which contributed to driving construction activity growth throughout 2013. However, 2014 has indicated that the broader economy may still have hurdles to overcome to sustain longer-term growth.

Germany has been the strongest performer in the region in terms of GDP growth in recent years despite some volatility in 2014. While France has also gained some ground. Structurally more sound, and with lower unemployment than elsewhere in the region, Germany's industrial sector is expected to do the bulk of the heavy lifting in terms of Euro area growth.

Italy and several other parts of the region are only expected to see modest improvements. The rebalancing in these countries has been hampered by austerity measures, insufficient demand and an ageing population.

Some countries have seen export gains, but a marked rebound will also depend on structural shifts, such as productivity improvements linked to the reallocation of labor to growth sectors.



Contribution to Euro area annual growth and forecasts

Source: Westpac Economics

Eurostat reports show that construction activity across Europe is yet to improve significantly, with most of the resurgence in the east. This is reflected in the production in construction index, which measures the output and activity of the building construction and civil engineering sectors. In the first half of 2014, Portugal and Italy registered some of the lowest levels on the index of construction activity. Turkey, Sweden, Hungary and Poland saw greater volumes of activity during this period.

Over the year to March 2014, the volume of construction has risen most notably in Hungary (up 33 percent), Poland (up 18 percent) and Germany (up 12 percent). Others such as Portugal and Italy saw a decline in construction activity.

European Union annual change in building and engineering construction



82



European Union change in building and engineering construction

Source: Eurostat



European Union production in the construction sector index

Source: Eurostat, 2010 = 100. The European Union (EU28) includes Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom.



EUROPE — RELATIVE COST OF CONSTRUCTION

Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects. Source: AECOM



EUROPE — BUILDING COSTS

	ondon K	aris rance	loscow tussia	stana azakhstan	iev Ikraine	aku zerbaijan	stanbul urkey	ladrid ipain	tucharest tomania	ublin eland	rague :zech tepublic
			212	4 X	хЭ			20	шœ		
						USD/	m²				
Residential	0.000	0.400	4 500	1.000	070	4 000	050	4 700	04/0	0.000	4.045
Average multi unit high-rise	2,900	3,190	1,500	1,000	870	1,800	850	1,700	2,140	2,600	1,615
Luxury unit high-rise	3,900	4,440	2,000	1,200	1,450	2,380	1,6/5	2,400	3,130	3,500	2,220
Individual prestige homes	2,450	2,780	2,600	1,500		1,600	1,400	2,700	550	2,200	1,515
Commercial											
Average standard offices, high-rise	3,090	3,330	2,000		900	2,700	1,150	2,500	2,600	2,850	1,765
Prestige offices, high-rise	3,900	4,440	2,500	2,100	1,650	3,400	1,760	2,700	3,730	3,600	2,270
Major shopping center (CBD)	5,530	4,860	1,500	1,100	1,200	1,940	1,350	4,000	1,630	4,750	3,275
Industrial											
Light duty factory	1,580	1,670	1,000	900	450	1,500	750	1,000	415	1,500	855
Heavy duty factory	2,610	2,500	1,900	1,100		2,100	1,900	1,500	800	2,500	1,415
Hotel											
Three-star budget	2,610	3,060	2,200	1,490		2,000	1,870	2,500	1,100	2,500	1,915
Five-star budget	5,220	6,530	3,500	2,900	1,700	3,890	3,800	3,500	1,600	4,000	3,930
Resort style	2,970	3,470	2,700			2,200	1,750	3,000		2,600	2,120
Other											
Multi-storey car park	730	830	650	800		1,410	550	700	1,100	700	555
District hospital	3,130	3,750	2,250	2,800		2,710	1,640	3,300	2,430	3,150	
Primary and secondary schools	2,610	3,060	1,400	1,300		2,170	1,100	1,800	1,890	1,400	1,765
Sports arena					2,600						
	GBP	EUR	RUB	KZT	UAH	AZN	TRY	EUR	RON	EUR	CZK
USD =	0.59	0.72	35.69	184.39	9.70	0.78	2.20	0.72	3.26	0.72	19.80

Base date for all costs = Q2 2014

Costs exclude land and site acquisition, external works, professional fees, tenant fit-out and equipment, GST/VAT (where applicable). Hotel benchmark rate includes fixtures, furnishing and equipment.

EUROPE — MAJOR UNIT RATES

		London
	UNIT	GBP
Basement excavation	m³	35
Foundation excavation	m³	43
Imported structural fill	m³	40
Concrete in pad footing (25Mpa)	m³	590
Concrete in wall (32Mpa)	m³	585
Concrete in suspended slab (32Mpa)	m³	425
Formwork to slab soffit	m²	36
Formwork to side and soffit of beam	m²	41
Precast wall panel architectural with sand blast finish	m²	270
Reinforcement in beam	t	1,030
Structural steel in beam	t	1,500
Structural steel in truss	t	2,360
Aluminium framed window 6.5mm clear glass	m²	295
Aluminium panel curtain wall system (including structural system)	m²	500
Steel stud partition (framing)	m²	30
Plasterboard 13mm thick to partition	m²	8
Suspended mineral fiber ceiling tile	m²	18
Paint on plasterboard wall	m²	4
Ceramic tiles to wall	m²	27
Non-slip vinyl to wet areas	m²	23
Anti static carpet tile to office and admin areas	m²	27
Anti static broadloom carpet to office and admin areas	m²	32
Aluminium framed shopfront	m²	695

EUROPE — CONSTRUCTION COST INDICES



Adjusted Q1 2008 = 100 Source: AECOM

	London	Ireland
Q1 2008	545	298
Q2 2008	546	
Q3 2008	538	
Q4 2008	502	
Q1 2009	499	250
Q2 2009	473	
Q3 2009	458	
Q4 2009	454	
Q1 2010	457	233
Q2 2010	453	
Q3 2010	451	
Q4 2010	447	
Q1 2011	446	240
Q2 2011	447	
Q3 2011	447	
Q4 2011	443	
Q1 2012	446	247
Q2 2012	445	
Q3 2012	442	
Q4 2012	438	
Q1 2013	440	254
Q2 2013	443	
Q3 2013	447	
Q4 2013	453	
Q1 2014	459	262
2Q 2014	464	
3Q 2014	470	
Q4 2014	476	
1Q 2015	481	270

87

MIDDLE EAST

Zayed University Abu Dhabi, United Arab Emirates

MARKET TRENDS

Growth in the Middle East construction market over the past year was mixed with the United Arab Emirates (UAE) showing the most improvement. This performance is reflected in the results of the AECOM 2014 Middle East Construction Survey. Spending plans in Saudi Arabia, Qatar and Kuwait stalled due to slow political decision-making and project scope revisions. Government investment commitments remain a key risk, while political uncertainty, instability and security concerns have also affected some parts of the region.

Positive views on growth

Looking ahead, the majority of respondents are optimistic about growth. U.A.E. respondents are the most positive market, while those in Egypt and Kuwait are more doubtful about industry prospects.

Several respondents drew parallels with the preceding economic cycle and opinions were divided about whether anticipated growth will be driven by fundamentals or speculation. While 36 percent of industry respondents believe that growth is being driven by a fundamental improvement in demand,

28 percent still see speculation as the primary driver. This uncertainty highlights the vulnerability of the market, should sentiment turn.

In the U.A.E., there is more of a general consensus about growth. This is primarily driven by latent demand spurred on by stronger economic growth and improved sentiment. Generally, the industry is expecting financial restrictions to ease. helping the flow of government-led projects and increasing access to debt finance for projects from a broader array of sources.

Workload expectations in the U.A.E. are driven by infrastructure and transport investment such as aviation, while work associated with the Expo 2020 is seen as a catalyst for real estate projects.

In Qatar workload expectations center around preparations for the 2020 FIFA World Cup and associated infrastructure investments. Although these have been impacted by news that the government may downsize the scope of the event. This may include cuts to the number of stadiums and the Doha Metro scheme. While economically, given the size of the



Workload expectations and drivers

Industry workloads

Demand fundamentals

Future growth will be driven by ...



country, it may make sense to reduce the scale of investments, it does create uncertainty in the industry supply chain.

Despite the slower than anticipated flow of project awards in Saudi Arabia over the past 18 months, expectations are that several previously delayed largescale transport and social infrastructure projects (for example in education) will finally be executed.

Industry participants expecting strong workload growth for their companies over the next three years cite having rationalized and reorganized since the recession as their main strength to capitalize on the economic upturn. Some also report that their mobility and flexibility are their greatest strengths, allowing them to respond swiftly to upcoming opportunities.



Expected project awards 2014-16

Gulf Cooperation Council countries + Iraq Number of progressed projects Total: US\$876.7 billion

Expected changes to project financing

Net respondent expectations over the next 3 years



Source: AECOM Middle East Construction Survey 2014

Growth sectors

According to our research, construction opportunities backed by real economic, social and global events are the main reasons for industry confidence in the region. This is driving business across a number of big-ticket public capital projects. A low-tax environment, relatively low regulatory restrictions and stability of countries are also encouraging businesses to invest. Economic growth, urbanization and population increases are also placing pressure on water, electricity, transport and social infrastructure.

Transport is seen as the dominant sector with a boom in airport-related work, metros in several cities and other initiatives. According to MEED, there is US\$278 billion worth of transport projects in the current award pipeline. Housing is also a priority area with several large-scale programs planned. Construction firms remain heavily dependent upon government infrastructure plans for future growth. with two-thirds of our survey respondents citing this as the single most important market driver. Such reliance means that any public belt tightening would significantly affect the pipeline of projects.

Challenges and risks

One of the key improvements identified in industry practice is the focus on Building Information Modeling (BIM) and how this is impacting project performance in the region. The market is also benefiting from advancements in the prioritization of projects; transparency and accountability; and business case evaluation. This is helping the supply chain to invest in resources and plan ahead to deliver projects.

Of all the potential barriers to progress, the biggest concerns are over political continuity in the context of geopolitical risks, resource availability, and changes in government spending. Private sector financing, risk management, and bureaucracy and regulation are also seen as major challenges to the regional industry.

Industry participants also noted a significant opportunity to improve the performance of projects, with 78 percent identifying projects they have worked on as "underperforming" Leading causes of this trend include: unrealistic time frames, scope creep, consultation and engagement, and more generally, the need for greater collaboration across the entire client and project team.

Underperforming projects in the Middle East



Yes

Source: AECOM Middle East Construction Survey 2014

74%

74%

61%

48%

MIDDLE EAST — RELATIVE COST OF CONSTRUCTION



Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects. Source: AECOM



MIDDLE EAST — BUILDING COSTS

	eirut banon	yadh S.A.	oha Itar	anama thrain	uscat nan	ıbai A.E.
	Бе	μų Υ.	дõ	Вã	Ξō	ב ה
			USD	/ m²		
Residential						
Average multi unit high-rise	1,500	1,575	1,575	1,300		1,360
Luxury unit high-rise	1,800	1,890	2,150	1,600		1,800
Individual prestige homes	2,200	1,680	2,000	1,700	2,050	1,600
Commercial						
Average standard offices, high-rise	1,200	1,575	1,850	1,170		1,600
Prestige offices, high-rise	2,590	2,100	2,100	1,280		1,850
Major shopping center (CBD)	1,250	1,365	1,250	1,230	1,010	1,400
Industrial						
Light duty factory	825	735	990	620	780	630
Heavy duty factory	1,100	945	1,150	700	990	925
Hotel						
Three-star budget	1,850	1,785	2,100	1,800	1,650	2,150
Five-star budget	3,300	2,800	3,500	2,620	2,690	3,000
Resort style		3,360	3,950	3,200	3,410	3,600
Other						
Multi-storey car park	550	630	850	620	780	700
District hospital	3,000	2,100	3,800	2,450	2,310	3,050
Primary and secondary schools		1,155	1,300	1,510	1,300	1,500
	LBP	SAR	QAR	BHD	OMR	AED
USD =	1,484	3.75	3.63	0.37	0.38	3.67

Base date for all costs = Q2 2014

MIDDLE EAST — MAJOR UNIT RATES

		rut anon	adh .A.	ar	nama ırain	scat an	.E.
		Bei Leb	Riy K.S	Dol Qat	Ma Bal	Mu	U.A.U
	UNIT			USD			
Basement excavation	m°	15	12	14	7	5	4
Foundation excavation	m°	16	14	15	8	7	14
Imported structural fill	m°	35	14	32	18	13	22
Concrete in pad footings (25Mpa)	m³	125	131	150	117	93	95
Concrete in walls (32Mpa)	m°	135	137	160	122	101	112
Concrete in slabs (32Mpa)	m³	125	137	160	117	96	109
Formwork to slab soffits (under 5m high)	m²	20	34	44	20	23	31
Formwork to side and soffits of beams	m²	23	42	44	21	18	33
Precast wall panel architectural with sand blast finish	m²	200	210	185	205	246	182
Reinforcement in beams	kg	1.1	1.3	1.4	1.2	1.1	1.3
Structural steel in beams	kg	3.5	4	4	3	3	3
Structural steel in trusses	kg	3.5	4	4	3	3	3
Hollow concrete block partition (200mm thick)	M2	30	32	44	27	22	54
Aluminium framed window (6.5mm clear glass commercial quality)	M2	250	462	260	220	263	272
Aluminium curtain wall system (including structural system)	M2	700	646	600	583	513	540
Average quality steel stud partition (with single layer plasterboard each side)	M2	50	54	95	52	54	40
Suspended mineral fiber ceiling	m²	32	37	36	40	33	45
Paint on plasterboard walls	m²	10	8	5	5	5	5
Ceramic tiles to walls	m²	35	37	70	53	33	45
Average quality marble paving on screed	m²	130	168	200	160	109	163
Anti static carpet tiles to office and admin areas	m²	65	63	74	50	71	55
		LBP	SAR	QAR	BHD	OMR	AED
USD =		1,484	3.75	3.63	0.37	0.38	3.67

MIDDLE EAST — CONSTRUCTION COST INDICES



	Construction Unit Rates Index	Materials and Commodities Index
2009	103.5	89.6
2010	104.9	108.1
2011	100.1	125.8
2012	95.1	120.6
2013	96.5	114.4
2014e	99.6	112.3

Tender Price Index forecast is indicative only and is based on AECOM view as at July 2014.

Material Price Index forecast is indicative and based on IMF forecasts as at July 2014.

Forecasts are subject to chance without prior notice.

Source: AECOM, IMF, ME Steel

NORTH AMERICA

One World Trade Center

mage: Michael Mahesh, The Port Authority of NY & N.

MARKET TRENDS

The North American region is beginning to show further signs of life after some set-backs in growth. While some of them were temporary and related to the severity of winter, others are more ingrained, such as demand-side weakness.

The U.S. Congressional Budget Office expects the economy to grow by 1.5 percent during 2014, a revision down from previous expectations, but growth expectations for 2015 are better at 3.4 percent, as underlying conditions improve. Increases in wealth which occurred during 2013 have helped improve consumer and business sentiment and by 2015 unemployment is expected to fall below six percent. The Canadian economy also suffered from the effects of poor weather, but it too is beginning to see gains, particularly for commodity producers and the manufacturing sector, which benefit from a weaker Canadian dollar.

In the U.S. construction market, recovery has been led by investment in the residential sector with private housing starts in July 2014 up 22 percent year on year. Investment in hotels has also surged, but is still a relatively small market in terms of comparative spend, according to U.S. Census Bureau figures.



U.S. construction investment

Values based on current year construction spend in USD. Source: U.S. Census Bureau Education has been performing solidly, as has infrastructure, which has been spurred on by demand for new power and transport infrastructure, such as the shift towards renewables and light rail. Growth in the gas market and some parts of manufacturing are also driving construction investment.

The pace of recovery in dwelling starts since the lows of the 2011 market has been somewhat erratic but is showing a general upwards trend, rising to more than 90,000 new builds a month. This is well below the peaks of 2005. Gains in the jobs market have predominantly been in mining, oil and gas, and services industries such as education, health and leisure (Brookings Institute, Moody's). Construction — one of the areas hit hardest by the downturn — is yet to make significant gains, despite gaining some ground in the year to March 2014.

New homes in the U.S.



New privately-owned housing units per month. Source: U.S. Census Bureau

U.S. jobs recovery by sector



Net recovery indicates the change in jobs in that sector since the U.S. jobs recession. Positive figures indicate a net gain of jobs in this sector.

Source: Brookings Institute, Moody's



NORTH AMERICA — RELATIVE COST OF CONSTRUCTION

Relative cost of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects. Source: AECOM



Change since 2008

NORTH AMERICA — CONSTRUCTION COST INDICES

Index 120 115 110 105 100 95 Q1 2010 Q2 2010 Q3 2010 Q4 2010 Q2 2012 Q3 2012 Q4 2012 Q1 2013 Q2 2013 Q3 2013 Q4 2013 Q1 2014 Q2 2014 Q1 2009 Q1 2011 Q2 2011 Q3 2011 Q4 2011 Q1 2012 Q1 2008 Q2 2008 Q3 2008 Q2 2009 Q3 2009 Q4 2009 Q4 2008 RS Means 30-City ENR 20-City U.S. CPI U.S. PPI AECOM Construction _ -Average (U.S.) BCI (U.S.) Index (U.S.)

	RS Means 30-City Average (U.S.)	ENR 20-City BCI (U.S.)	U.S. CPI	U.S. PPI	AECOM Construction Index (U.S.)
Q1 2008	171	4,557	211	172	1.41
Q2 2008	173	4,577	215	177	1.48
Q3 2008	180	4,723	220	185	1.56
Q4 2008	184	4,867	217	177	1.53
Q1 2009	183	4,782	211	170	1.42
Q2 2009	179	4,761	213	170	1.38
Q3 2009	180	4,762	215	172	1.38
Q4 2009	181	4,762	216	174	1.41
Q1 2010	182	4,800	217	178	1.43
Q2 2010	182	4,817	218	180	1.48
Q3 2010	184	4,910	218	180	1.47
Q4 2010	184	4,947	219	181	1.48
Q1 2011	186	4,969	220	184	1.51
Q2 2011	188	5,028	225	191	1.57
Q3 2011	191	5,074	226	192	1.58
Q4 2011	193	5,104	226	192	1.56
Q1 2012	194	5,122	227	192	1.57
Q2 2012	194	5,150	230	195	1.58
Q3 2012	195	5,184	229	193	1.57
Q4 2012	196	5,204	231	196	1.56
Q1 2013	197	5,226	230	195	1.58
Q2 2013	198	5,257	233	196	1.59
Q3 2013	201	5,281	234	197	1.57
Q4 2013	202	5,308	234	197	1.57
Q1 2014	203	5,324	234	198	1.59
Q2 2014	204	5,357	237	202	1.59

Sources: RS Means Construction Cost Indexes, Reed Construction Data
McGraw Hill Construction (Engineering News-Record)
U.S. Consumer Price Index, U.S. Bureau of Labor Statistics
U.S. Producer Price Index U.S. Bureau of

U.S. Producer Price Index, U.S. Bureau of Labor Statistics AECOM

NORTH AMERICA — BUILDING COSTS

	~		ton DC	eles	Icisco						_		٥ď	er
	New York	Chicago	Washing	Los Ange	San Fran	Atlanta	St. Louis	Miami	Seattle	Toronto	Montreal	Ottawa	Winnipeg	Vancouv
		USD / ft ²								C	AD /	ft²		
Residential														
Low-rise – multi unit	260	232	200	218	260	177	203	178	220	235	232	235	227	233
Low-rise – high quality	412	360	311	366	404	273	314	277	342	366	361	366	352	362
High-rise – medium quality	401	357	308	381	399	270	310	273	338	362	357	362	347	358
High-rise – high quality	491	431	372	466	483	327	375	331	409	438	431	438	421	433
Podium car parking	167	150	128	140	167	113	130	114	141	151	150	151	146	150
Basement car parking	297	266	229	249	297	202	231	203	252	269	265	269	259	266
Commercial														
Average standard offices														
- Low-rise	363	324	280	305	363	246	282	249	308	329	324	329	317	326
- Medium-rise	393	350	302	330	393	266	306	269	333	356	350	356	343	353
- High-rise	426	377	325	386	423	286	329	290	358	383	377	383	368	379
High standard offices	481	427	368	452	478	324	372	328	405	433	427	433	416	429
Industrial														
Light industrial – low bay, tilt-up	153	135	116	125	151	102	117	103	127	137	134	137	131	135
Heavy industrial – high bay, tilt up	201	177	152	171	198	134	153	136	167	179	177	179	172	177
Attached offices	226	202	174	190	226	152	176	154	191	204	201	204	197	203
Hotel														
Resort	502	448	386	491	502	340	390	344	425	453	448	453	438	450
Three-star budget*	241	211	181	226	236	160	183	162	200	214	210	214	205	212
Five-star/luxury*	504	439	378	481	491	333	382	336	416	444	439	444	428	440
Suburban motel*	175	156	135	147	175	118	136	120	148	158	156	158	152	157
Health														
District medical center	727	648	559	609	727	491	565	497	615	658	648	658	634	652
District hospital	682	672	579	732	753	509	584	516	636	681	672	681	656	674
Nursing home – *including a/c	390	348	300	327	390	264	303	268	330	353	348	353	340	349
Retail														
District center	336	298	257	291	334	227	260	229	283	303	298	303	291	300
Regional center	265	236	203	222	265	179	205	181	224	240	236	240	231	237
Strip shopping	173	154	133	145	173	117	135	118	146	157	155	157	151	155
Education														
Primary schools	391	309	267	321	347	234	269	237	294	313	309	313	302	310
Secondary schools	397	354	305	333	397	268	308	271	335	359	354	359	346	356

Base date for all costs = Q2 2014

1 USD = 1.11 CAD

Conversion: 1 m^2 = 10.76 ft²

*Including FF&E

NORTH AMERICA — MAJOR UNIT RATES

		New York	Chicago	Washington DC	Los Angeles	San Francisco	Atlanta	St. Louis	Miami	Seattle	Tourset	Montreal	Ottawa	Winnipeg	Vancouver
l	JNIT					U	USD						CA	CAD	
Basement excavation	ft3	26.90	23.85	20.75	22.30	26.90	18.45	20.75	18.45	23.10	27.3	26.45	27.30	25.60	26.45
Foundation excavation	ft3	57.70	51.55	44.60	48.45	57.70	39.25	44.60	39.25	48.45	58.0	5 57.20	58.05	55.50	58.05
Imported structural fill	ft³	34.60	30.75	26.90	29.25	34.60	23.10	26.90	23.85	29.25	35.0	34.15	35.00	33.30	34.15
Concrete in pad footing (25Mpa)	ft³	250.00	223.10	192.30	211.50	250.00	169.20	196.20	173.10	211.50	251.9	247.60	251.90	243.30	247.60
Concrete in wall (32Mpa)	ft3	292.30	261.50	223.10	246.20	292.30	196.20	226.90	200.00	246.20	294.6	290.30	294.60	281.80	290.30
Concrete in suspended slab (32Mpa)	ft³	276.90	246.20	211.50	230.80	276.90	188.50	215.40	188.50	234.60	277.5	273.20	277.50	269.00	277.50
Formwork to slab soffit	ft²	16.70	14.90	13.00	13.90	16.70	11.10	13.00	11.60	13.90	17.0) 16.50	17.00	16.00	16.50
Formwork to side and soffit of beam	ft²	20.40	18.10	15.80	17.20	20.40	13.90	15.80	13.90	17.20	20.6	20.10	20.60	19.60	20.60
Precast wall panel architectural with sand blast finish	ft²	70.00	63.00	54.00	59.00	70.00	47.00	54.00	48.00	59.00	71.0	0 70.00	71.00	68.00	70.00
Reinforcement in beam	lb	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0	0 1.00	1.00	1.00	1.00
Structural steel in beam	ton	4,118	3,673	3,173	3,455	4,118	2,791	3,200	2,818	3,482	4,13	7 4,077	4,137	3,976	4,097
Structural steel in truss	ton	5,091	4,545	3,918	4,273	5,091	3,445	3,955	3,482	4,309	5,11	5,045	5,116	4,924	5,066
Aluminium framed glass	ft²	88.00	79.00	68.00	74.00	88.00	60.00	69.00	60.00	75.00	89.0	88.00	89.00	85.00	88.00
Aluminium panel curtain wall system (including structural system)	ft²	125.00	112.00	97.00	105.00	125.00	85.00	98.00	86.00	106.00	126.0) 124.00	126.00	121.00	125.00
Steel stud partition (framing)	ft²	6.05	5.40	4.65	5.10	6.05	4.10	4.75	4.20	5.10	6.1	0 6.00	6.10	5.90	6.10
Plasterboard 13mm thick to partition	ft²	3.25	2.90	2.50	2.70	3.25	2.25	2.50	2.25	2.80	3.3	3.20	3.30	3.10	3.20
Suspended mineral fiber ceiling tile	ft²	6.05	5.40	4.65	5.10	6.05	4.10	4.75	4.20	5.10	6.1	0 6.00	6.10	5.90	6.10
Paint on plasterboard wall	ft²	1.60	1.40	1.20	1.30	1.60	1.10	1.20	1.10	1.30	1.6	5 1.65	1.65	1.45	1.65
Ceramic tiles to wall	ft²	16.70	14.90	13.00	14.40	16.70	11.60	13.00	11.60	14.40	17.0) 16.50	17.00	16.50	17.00
Non-slip vinyl to wet areas	ft²	9.00	8.10	7.00	7.50	9.00	6.10	7.00	6.10	7.60	9.1	9.00	9.10	8.70	9.00
Anti static carpet tile to office and admin areas	ft²	7.20	6.40	5.50	6.00	7.20	4.80	5.60	4.90	6.00	7.2	0 7.10	7.20	6.90	7.10
Anti static broadloom carpet to office and admin areas	ft²	7.00	6.20	5.40	5.90	7.00	4.70	5.40	4.70	5.90	7.0	0 6.90	7.00	6.70	7.00
Aluminium framed shopfront	ft²	63.00	56.00	49.00	53.00	63.00	43.00	49.00	43.00	53.00	63.0	0 62.00	63.00	61.00	63.00



CLOSING REMARKS ON PRODUCTIVITY

Productivity must be addressed with a view toward the entire asset lifecycle — design, build, finance and operate.

Collectively we can enhance the built environment through an integrated approach that encourages collaboration and partnerships.

AECOM's vision to become the world's premier, fully integrated infrastructure firm is aligned to achieving these productivity goals.

Construction management

From planning, architecture and design, to construction management and operations and maintenance, to cyber security and information technology services, logistics and support services, we contribute to every phase of the complete project lifecycle.

We do all this through the combined capabilities of our people around the globe. Alongside our trusted partners we create, enhance and sustain the world's built, natural and social environments.

Strategic asset management End user research Occupier strategies Economics + planning Management consultancy Asset planning Workplace + interiors strategies Review effectiveness Facilities management Change management Occupier strategies Masterplanning Building surveying Workplace + interiors strategies ocupancy Project plan/ business case Use Asset lifecycle Construction Project brief Project management Economics + planning Cost management Project management Architectural design Cost management Landscape architecture Detailed desigr Value + risk management Interior design Environmental + ecological planning Procurement strategy **Fiscal** incentives Value + risk management Sustainability Conditions for success planning Building engineering Supply chain management Sustainability Health & safety management

Enhancing projects throughout the entire asset lifecycle

AECOM CONTACTS

The Blue Book 2014

Editorial director

Michael Skelton michael.skelton@aecom.com

Content lead

Brigid Stapleton brigid.stapleton@aecom.com

Design lead

Katina Martin-Unterberger katina.martin-unterberger@aecom.com

Key contacts

BUILDING RESILIENT PLACES

Americas

Claire Bonham-Carter claire.bonham-carter@aecom.com

Xin Li xin.li@aecom.com

Alexander Quinn alexander.quinn@aecom.com

Avinash Srivastava avinash.srivastava@aecom.com

T. Luke Young t.luke.young@aecom.com

Eric Zickler eric.zickler@aecom.com

Asia

Thomas S. K. Tang sk.tang@aecom.com

Australasia

Michael Nolan michael.nolan@aecom.com

Tim O'Loan tim.o'loan@aecom.com

Lester Partridge lester.partridge@aecom.com

Roger Swinbourne roger.swinbourne@aecom.com

Europe

Matthew Jones matthew.d.jones@aecom.com

ENHANCING THE USER EXPERIENCE

Americas

Christine Devens christine.devens@aecom.com

Emily Golembiewski emily.golembiewski@aecom.com

Andrew Laing andrew.laing@aecom.com

David Stone david.stone@aecom.com

Australasia

Adam G. Williams adam.williams@aecom.com

Sue Wittenoom sue.wittenoom@aecom.com

Europe

John Hicks john.hicks@aecom.com

Hilary Jeffery hilary.jeffery@aecom.com

INNOVATIVE CONSTRUCTION

Africa

Graeme Harper graeme.harper@aecom.com

Americas

Bill Looney bill.looney@aecom.com

Dan McQuade daniel.mcquade@aecom.com

Dan Tishman dan.tishman@aecom.com

James Wallace james.wallace@aecom.com

Asia

Francis Leong francis.leong@aecom.com
AECOM CONTACTS

Andy North andy.north@aecom.com

Keith Tang keith.tang@aecom.com

Australasia

Nick Hewson nick.hewson@aecom.com

Thomas Mitchell thomas.mitchell@aecom.com

Alan Baker alan.baker@aecom.com

Europe

Tim Butler tim.butler@aecom.com

Graham Thomson graham.thomson@aecom.com

Middle East

Mark Fletcher mark.fletcher@aecom.com

David McKenzie david.mckenzie@aecom.com

RESTRUCTURING LABOR

Asia

Billy Wong billy.wong@aecom.com

Australasia

Matthew Heal matthew.heal@aecom.com

Michael Skelton michael.skelton@aecom.com

Europe

Oliver Baker oliver.baker@aecom.com

Mairi Johnson mairi.johnson@aecom.com

Middle East

Elizabeth Peters elizabeth.peters@aecom.com

TECHNOLOGY TRANSFORMING INDUSTRY

Americas

JJ Riestra jj.riestra@aecom.com

Dennis Rodriguez dennis.rodriguez@aecom.com

Asia

Hongyu Li hongyu.li@aecom.com

Australasia

Steve Appleby steve.appleby@aecom.com

Europe

Chris Hindle chris.hindle@aecom.com

Graham Jones graham.jones@aecom.com

ALTERNATIVE FINANCING

Americas

Christine Chadwick christine.chadwick@aecom.com

Darcy Immerman darcy.immerman@aecom.com

John T. Livingston john.livingston@aecom.com

Asia

Chris Yoshii chris.yoshii@aecom.com

Australasia

Ed Brown edward.brown@aecom.com

Philip Davies philip.davies@aecom.com

Europe

Rachel Sanders rachel.sanders@aecom.com

AFCOM CONTACTS

Geography leaders

Americas

Bob Pell bob.pell@aecom.com

Asia Pacific

Chi Chung Wong chichung.wong@aecom.com

Europe, Middle East + Africa

Peter Flint peter.flint@aecom.com

Market intelligence contacts

Africa

Len Holder len.holder@aecom.com

Americas

Peter Morris peter.morris@aecom.com

Asia

Chye Hian Soh chyehian.soh@davislangdon.com

Australasia

Michael Skelton michael.skelton@aecom.com

Brigid Stapleton brigid.stapleton@aecom.com

Europe

Jay Kotecha jay.kotecha@aecom.com

Middle East

Maren Baldauf-Cunnington maren.baldauf-cunnington@aecom.com

AECOM has compiled the information in this document from a number of sources. AECOM has not verified that such information is correct, accurate or complete. Whilst every care has been taken in the preparation of this document, AECOM makes no representation or warranty as to the accuracy or completeness of any statement in it including, without limitation, any forecasts. Historical trends are not necessarily a reliable indicator for actual future performance. AECOM accepts no liability or responsibility to any party in respect of this document. This document has been prepared for the purpose of providing general information, without taking account of any particular person's objectives, situation or needs. You should seek professional advice having regard to your own objectives, situation and needs before taking any action.



About AECOM

Ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 45,000 employees including architects, engineers, designers, planners, scientists and management and construction services professionals serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments. A Fortune 500 company, AECOM has annual revenue of approximately \$8.0 billion.

More information on AECOM and its services can be found at www.aecom.com.

Follow us on Twitter: @aecom