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EVERYTHING FITS

The cost-benefit impact of off-site manufacturing: saving labour, time and reducing risk

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INTRODUCTION

Despite the turbulence and challenges faced within the construction industry over the last decade, the Australian industry is being provided ample opportunity post-pandemic to recover and expand. Both the State and Federal Governments are continuing their focus on infrastructure development, and the industry is predicted to grow at a 3.1 per cent annual rate from 2024 to 2027.[1]

Though we have come a long way in the post-COVID recovery, the pandemic exacerbated some of the challenges facing the construction industry. Among these are a few recurring themes, including time constraints and labour shortages, rising cost of materials and safety risks to workers onsite. Given the positive outlook and projected growth within the construction industry, it is particularly important to address these main challenges to ensure its continued success.

Off-site manufacturing, which is the process by which construction items are planned, designed and manufactured at a location separate to the construction site, is an increasingly popular solution as it addresses some of these pain points. However, it is sometimes shrouded by misconceptions about the costs involved and the quality of the items produced. The reality is that off-site manufacturing can enhance project delivery by improving quality and safety, speeding up construction and saving money in the long run. As it continues to gain popularity in Australia and around the world,[2] off-site manufacturing may just be the industry's best kept secret-shortcut to delivering successful projects both on time and on budget.

[1] References
Linesight, "Australia Country Insights and Commodity Report," May 23, 2023, https://assets.ctfassets.net/1lsus2dflm8x/njr9bktG8gCX1YWZpQMS1/3654e2464b858c47396f48433ce6fc9e/Linesight_Australia_Country_Commodity___Insights_Report_Q1_2023__1_.pdf

[2] KPMG, "Familiar Challenges – New Approaches, 2023 Global Construction Survey," 2023, https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2023/06/familiar-challenges-new-solutions.pdf

WHAT IS OFF-SITE MANUFACTURING?

Off-site manufacturing refers to the process in which components and systems are produced using advanced manufacturing techniques in a controlled environment, before they are transported to and installed in their final position on-site. Stripped down to its core, off-site manufacturing takes construction and manufacturing from the worksite to an external facility that is specifically designed for construction and manufacturing. Off-site manufacturing and prefabrication can benefit a variety of construction and infrastructure projects, encompassing everything from residential buildings to commercial developments. The versatility of prefabrication processes allows for the production of a variety of systems, components and products. These can range from entire rooms or sections of buildings for residential buildings for example, to structural components such as handrails, balustrades and pathways.

Though off-site manufacturing is not a new process to the construction and infrastructure industries, technological advancements have improved modular construction and prefabrication, which is why it is now being utilised more often in the construction industry. KPMG's 2023 Global Construction Survey revealed that 61 per cent of respondents are beginning to adopt this technology for at least one project, and 84 per cent agree that prefabrication is an important solution for capital projects.[3] This approach is even recognised by the Victorian Government, with the Office of Projects Victoria having a goal to use off-site construction techniques where feasible and efficient, stating "the evidence is clear: rationalisation, standardisation modularisation and offsite construction can drive better results with quicker, safer, higher quality and more cost-efficient projects".[4]

[3] KPMG, "Australian Engineering and Construction Industry Highlights."

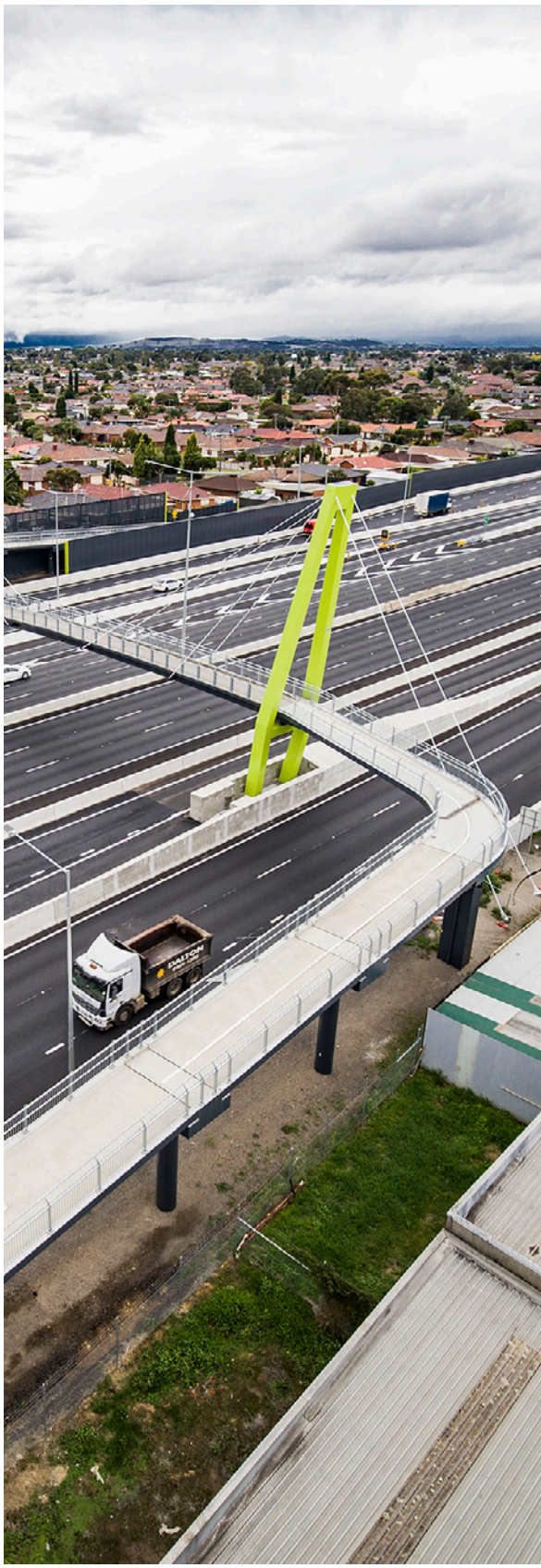
[4] Office of Projects Victoria, "Offsite construction," State Government of Victoria, March 17, 2023, https://www.vic.gov.au/offsite-construction#:~:text=Offsite%20construction%20involves%20combining%20conventional,costs%2C%20environmental%20impacts%20and%20productivity.

Despite its prevalence and popularity, there are still a number of misconceptions about off-site manufacturing. One such misconception is that the building materials used are of lower quality than those used in traditional construction and manufacturing. This, however, is untrue. Prefabricated products are manufactured with the same materials that are used in traditional construction; the only difference is where they are produced. Clients utilising off-site manufacturing have just as much control over the materials used in projects as they would if it were to be completed on-site. Another common misconception is that in their final form, prefabricated products are inferior to those produced in a traditional manner. The reality is that off-site manufacturing often results in higher quality products and more consistent results because of the controlled environment in which the items are produced. Prefabricated components are carefully designed and approved before they are produced using advanced manufacturing techniques that allow consistency and precise production, where there are multiple opportunities for quality checks and control.[5] Additionally, when working with a trusted partner, pre-engineered solutions are guaranteed to be fit-for-purpose compliant which ensures their safety and reliability.

Another often-cited concern about off-site manufacturing is that it is unsustainable, however sustainability is one of the primary advantages of utilising pre-engineered modular systems. Off-site manufacturing reduces the environmental impact of construction in several ways.[6]

- Less waste: the controlled nature of the factory environment reduces the waste produced due to precise measurement and reduced handling
- Decreased energy consumption: the use of equipment, tools and lighting is centralised to the one factory location which helps to decrease energy consumption
- Reduced transport emissions: pre-engineered components reduce the need for multiple trips to the site as components are only transported to the site once completed
- Quality assurance: off-site manufacturing employs frequent quality control measures, which produces consistent, quality results and reduces material waste.

Finally, some question whether off-site manufacturing is a cost effective and time efficient investment. The time and money saved by utilising off-site manufacturing and prefabricated solutions are two of its biggest advantages.



[5] Chauhan, Krishna, Peltokorpi, Antti, Lavikka, Rita & Seppänen, Olli, "The Monetary and Non-Monetary Impacts of Prefabrication on Construction: The Effects of Product Modularity," Buildings 12, no. 4 (2022): 459, https://doi.org/10.3390/buildings12040459

[6] Molly Larsen, "Manufacturing and how Moddex is Leading the Charge," Moddex, January 31, 2023, https://moddex.com/revolutionizing-construction-the-advantages-of-off-site-manufacturing-and-how-moddex-is-leading-the-charge/

COST-BENEFITS OF UTILISING OFF-SITE MANUFACTURING

Utilising off-site manufacturing has a variety of benefits for construction projects, with one of the most appealing being the money it saves. Budgeting has always been an important factor to consider for construction projects, and this has only been compounded post-COVID, and amid the ever-increasing cost of supplies. The ways in which off-site manufacturing cuts costs are many, however one of the most influential factors is in the time it saves. It is well known and understood in the construction industry that time is money, and off-site manufacturing earns businesses' time back in more ways than one.

Firstly, off-site specialist manufacturers offer a fast turnaround in the production of smart, functional and easy-to-install products. This is because the manufacturing processes in off-site facilities are optimised for efficiency and are well equipped to meet tight project deadlines, meaning they are able to get the job done quickly and efficiently to a high standard. In addition, as the majority of this process takes place indoors, it lessens time delays triggered by factors such as bad weather, theft and vandalism that can heavily impact on-site construction.

One of the most immediate benefits of utilising off-site manufacturing is the reduction in volume of on-site work, which minimises on-site disruptions and frees up physical space for other important projects that are to be completed on-site. Off-site manufacturing also allows for greater control over the production process, as there is far greater opportunity for quality control. Prefabrication and modular manufacturing produce more consistent and higher quality results due to the controlled nature of the factory environment. Furthermore, relocating and outsourcing manufacturing to an external facility also functions to reduce the risk of errors. Getting it right the first time guarantees that everything fits – this saves both money and time for the clients by mitigating costly rework. Similarly, every component complies with relevant standards and regulations, avoiding the financial penalties associated with failing to be in compliance.

The construction industry in Australia continues to be affected by persistent labour shortages which can lead to additional costs brought on by factors such as increased workplace injuries, lowered productivity, project delays and quality control issues.[7] Employing off-site construction removes the need for specialist trades to manufacture products, reducing the pressure on the on-site workforce which may help to prevent some of the financial pressures of labour shortages. Prefabrication is also more cost-efficient than on-site construction due to the reduced labour costs in outsourcing the manufacturing.

[7] Procore, "How to Beat the Construction Labour Shortage with Construction Workforce Management," 2023, https://www.procore.com/en-au/article/how-to-beat-the-construction-labour-shortage-with-construction-workforce-management#:~:text=What%20does%20the%20labour%20shortage,and%20higher%20builder%20risk%20costs.

REDUCING RISK ON-SITE

Historically, the construction industry has been very dangerous for workers, and despite the introduction of work and safety regulations across Australia, it unfortunately remains a high-risk industry. The high risk of death and injury to construction workers prompted Work Safe Australia to include the industry as a national priority in the W*ork Health and Safety Strategy 2012-2022*.[8] Though the fatality rate has continued to fall in the midst of increased safety protocols and procedures, the incidence rate for serious claims from the construction industry is still well above the average.[9] Between 2015 to 2019, there were 150 worker fatalities in the construction industry in Australia,[10] and 16,088 workers' compensation claims involving at least one week off work from the construction industry in 2020-2021.[11] This equates to over 44 serious claims each day.

Needless to say, reducing risk to workers' health and safety must be a priority for all construction projects. Off-site manufacturing can play an important role for worker safety as it reduces risk on-site in a myriad of ways. Firstly, employing off-site manufacturing offers an opportunity to reduce safety risks by creating safer working conditions through the use of quality-controlled factory environments. Of course, utilising off-site manufacturing does not completely eliminate health and safety risks, however the risks are greatly reduced when employing prefabrication, as the factory environment the manufacturing takes place in is far more controlled with stringent health and safety practices in place to protect workers. Similarly, removing manufacturing from the construction site allows other on-site health and safety hazards to be more easily managed.

Reducing the number of people on-site also has benefits for worker health and safety. Not only does it have a positive impact on productivity, more importantly, it reduces congestion within working areas. This means that there is more physical space for labourers to do their jobs, which promotes a safer work environment.[12] Additionally, because off-site manufacturing speeds up the construction process, this further reduces health and safety risks by reducing the amount of time that workers spend on-site, limiting the risks of often unavoidable health and safety hazards. Components built off-site are quick and easy to assemble on-site, which reduces installation lead times once the components have been delivered, and eliminates the associated risks that come along with complicated and time-consuming on-site manufacturing.

Unfortunately, the construction industry carries inherent risks due to the nature of the work and it is likely impossible to completely remove all health and safety risks, however, utilising off-site and modular manufacturing solutions creates an environment that by design reduces risks, whilst also having the added benefit of increasing productivity and cutting costs, helping projects be delivered on-budget and on-time.

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[8] Safe Work Australia, "Infographic: Fatalities, Injuries and Solutions in Construction," March 26, 2020, https://www.safeworkaustralia.gov.au/resources-and-publications/infographic/infographic-fatalities-injuries-and-solutions-construction

[9] WorkSafe, "Construction Industry Stats: the Good and the Bad News," March 31, 2023, https://www.worksafe.qld.gov.au/news-and-events/newsletters/esafe-newsletters/esafe-editions/esafe-construction/march-2023/construction-industry-stats-the-good-and-the-bad-news

[10] Safe Work Australia, "Work-related Traumatic Injury Fatalities, Australia," 2019, https://www.safeworkaustralia.gov.au/sites/default/files/2020-11/Work-related%20traumatic%20injury%20fatalities%20Australia%202019.pdf

[11] Safe Work Australia, "Key Work Health and Safety Statistics Australia 2022," January 17, 2023, https://www.safeworkaustralia.gov.au/doc/key-work-health-and-safety-statistics-australia-2022

[12] Antillón, Eric, Morris, Matthew, Gregor, William, "A Value-Based Cost-Benefit Analysis of Prefabrication Processes in the Healthcare Sector: A Case Study," *Conference: 22nd Annual Conference of the International Group for Lean Construction* (2014): 995-1006, https://www.researchgate.net/publication/282778094_A_Value-Based_Cost-Benefit_Analysis_of_Prefabrication_Processes_in_the_Healthcare_Sector_A_Case_Study

FINDING A TRUSTED PARTNER: MODDEX'S END-TO-END PROCESS

When considering off-site manufacturing for a construction project, it's important to find a trusted partner who will support the vision and bring the project to life. As Australasia's leading manufacturer of innovative barrier systems for large-scale infrastructure and non-residential construction projects, Moddex's prefabricated handrail, balustrade and walkway systems offer a cleverly crafted and unique process for infrastructure and construction projects that combines modular systems with off-site manufacturing.

Compliance is an essential component of any construction or infrastructure project, as the Building Code was created to ensure there is a minimum standard of health and safety.[13] Though it can sometimes present additional challenges in the design and planning stages, failure to comply can lead to disastrous consequences ranging from injury to permanent disability or death. Luckily, Moddex are experts in compliance in both Australia and New Zealand, and all Moddex products are fit-for-purpose compliant. Moddex prioritises compliance at every stage of their end-to-end service to ensure the success of every project. Furthermore, they have a variety of resources available on their website to support project engineers in ensuring their projects stay in compliance.

Moddex's end-to-end service is designed to provide clients with a seamless and efficient barrier solution for their project, leveraging the off-site manufacturing process to allow greater control and produce quality products. The process begins with consultation and compliance advice. This is an important first step in which Moddex works with the client to understand the specific needs and requirements of the project. This includes scoping the physical site of the project, giving advice about any relevant compliance requirements, reviewing design specifications and discussing potential challenges or constraints.

Following this, Moddex develops a detailed project proposal for the client's review and approval, including costings, plans, producer statements and specifications for every product. Once the proposal is approved, Moddex's talented team of designers begin designing shop drawings, including detailed 3D models, for sign off by the client.

Once the designs are completed and approved, production management begins. Moddex's pre-engineered products are manufactured off-site in a controlled environment, using advanced manufacturing techniques to ensure each component is produced precisely and consistently.

Finally, the product is delivered to the project site. The material is provided in a flat pack with clear installation drawings, with all necessary pre-cut components and easy to follow instructions for installation that do not require specialist tools or drills and can therefore be done by any builder.

By their very design, Moddex's pre-engineered products are quick and easy to install, which reduces the need for on-site fabrication and minimises the risk of on-site errors.

Moddex's pre-engineered components reduce risks on-site as their modular systems do not require any welding. This immediately removes the associated safety hazards of grinding, welding and creating sparks in construction environments that may be flammable. Moddex renders hot works permits and toxic fume safety procedures redundant, as their no-weld solutions eliminate toxic fumes altogether, promoting a safer worksite.

Once installed, a maintenance manual and product and warranty certifications are supplied and the job is complete.

[13] Australian Business Licence and Information Service, "Building Code of Australia," Australian Government 2023, https://ablis.business.gov.au/service/ag/building-code-of-australia/31282

OFF-SITE MANUFACTURING IN ACTION: BLAXLAND BRIDGE

Moddex was selected as a trusted partner to assist with the Blaxland Bridge Upgrade as part of the Victorian Government's M80 Upgrade. The project is part of Victoria's Big Build and is a cornerstone of Victoria's major infrastructure overhaul. The upgrade will see the M80 Ring Road connect the expanding northern and western suburbs to major arterials such as the Hume, Tullamarine and Westgate freeways, as well as the future North East Link, which is another major infrastructure project born of Victoria's Big Build.

The M80 Upgrade will widen the freeway, widen the on and off ramps and instate a new freeway management system along 38km of road from Laverton North to Greensborough. This project is important as not only will it save time for the 165,000 motorists who use the road every day, but also increase capacity and importantly, improve safety.

The Blaxland Avenue Overpass, otherwise known as Blaxland Bridge, allows pedestrians and cyclists to cross this busy road safely and it too was upgraded as a part of the M80 Upgrade. Moddex was selected to design, manufacture and supply over 500 linear metres of bridge barriers for this upgrade using their proprietary Bridgerail™ Barrier System

Moddex designed the Bridgerail™ system to comply with AS5100.2 Clause 12.5, and it is perfectly suited to public access areas forming part of a road, rail or other elevated bridge structure. The proprietary system ensures balustrades on bridges such as the Blaxland Bridge can be specified and fitted effortlessly with guaranteed compliance. Bridgerail™ is modular in its assembly and is quick and easy to install as it does not require any welding. It is compatible with Moddex's Connectabal range, meaning the Bridgerail™ system can be customised whilst still meeting compliance in both Australia and New Zealand. With a 100-year design life and 30 per cent faster install than prefabricated systems, Bridgerail™ is the perfect balustrade solution.

Moddex is heavily involved in further sections of the M80 upgrade, designing and supplying a range of modular barrier systems for their construction partners,[14] allowing the project to reap the benefits of off-site manufacturing.

[14] Moddex, "M80 Ring Road Upgrade – Blaxland Bridge."

CONCLUSION

Off-site manufacturing presents a compelling solution to several challenges faced by the Australian construction and infrastructure industries. Though the post-pandemic era has resulted in new opportunities for growth for these industries, it has also magnified issues such as labour shortages and time and budget constraints. As it gains popularity, off-site manufacturing and prefabrication provides a valuable strategy that can enhance project delivery, reduce costs and mitigate risks.

Contrary to some persisting misconceptions, off-site construction, prefabrication and modular manufacturing can lead to higher-quality products in a much shorter time frame, reduced environmental impact and increased safety. One of the most significant advantages of off-site manufacturing is its cost-effectiveness – time saved through faster production, reduced disruptions and minimised rework directly translates into cost savings for the client. Additionally, off-site manufacturing enhances worker safety by creating controlled and safer working conditions through reduced congestion on-site and decreasing the time labourers spend in potentially dangerous environments.

As a trusted partner in off-site manufacturing, Moddex exemplifies the benefits of this approach. Their end-to-end process ensures fit-for-purpose compliance with both Australian and New Zealand regulations, which is crucial for both safety and quality assurance.

Moddex's contribution to the Blaxland Bridge Upgrade showcases how utilising off-site manufacturing can enhance safety and efficiency even in large-scale infrastructure projects. As the Australian construction industry continues to grow, implementing off-site manufacturing, pre-fabrication and modular manufacturing as a standard practice can pave the way for sustainable, cost effective and time efficient construction projects.