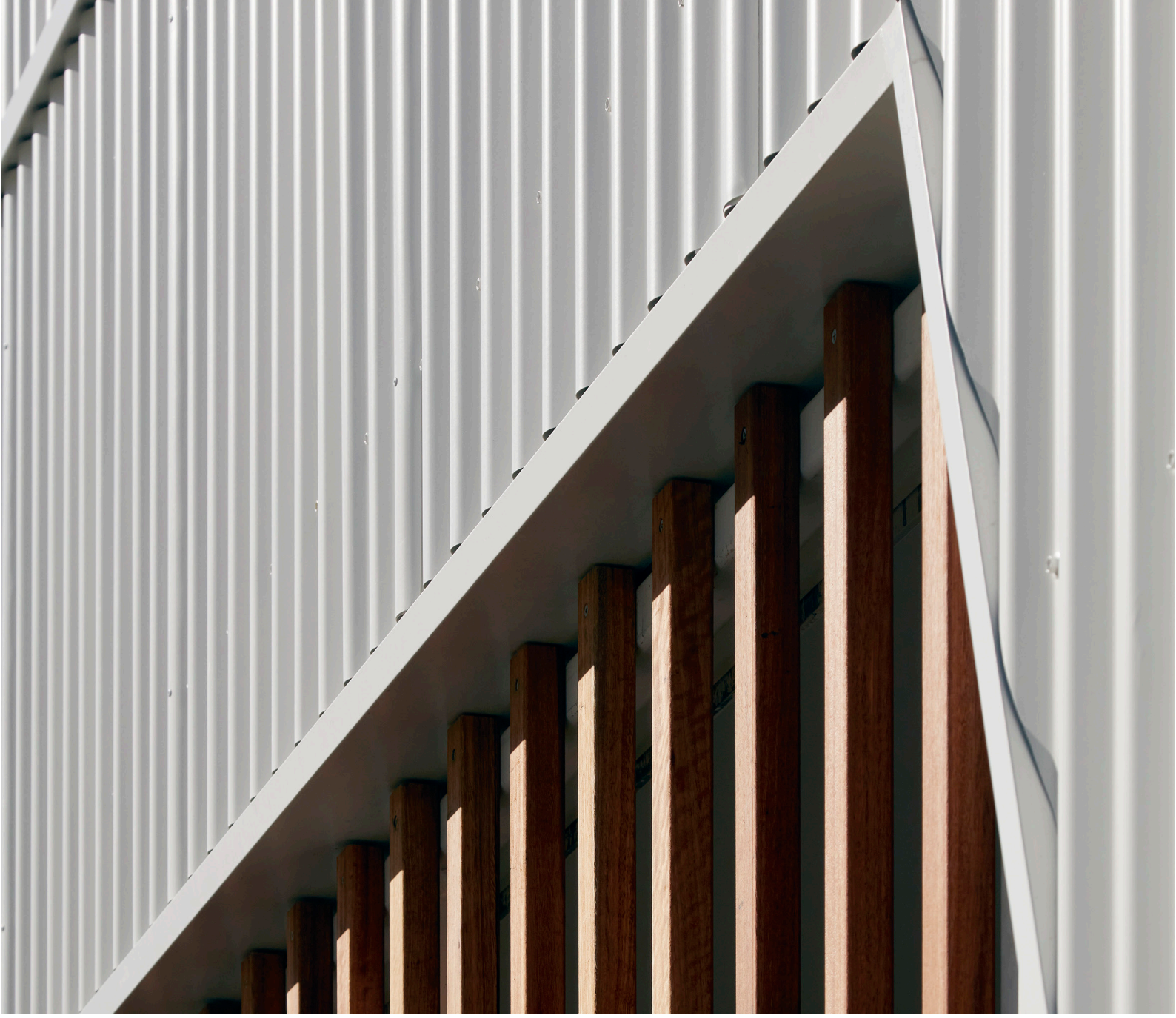


ARKIT

Advanced
Prefabricated
Architecture

PROTOTYPING FOR MODERN METHODS OF CONSTRUCTION: BEST-PRACTICE GUIDE

Introduction

The best way to radically increase certainty, value & return on investment [ROI] in design, construction, offsite manufacturing and the full spectrum of Modern Methods of Construction [MMC] is to prototype.

The Case for Prototyping

In problem-solving for how to do construction better, we know that prototyping is not an optional extra, but a critical and foundational activity for de-risking any new building system, product, or design - and best done as early as possible. Whilst prototyping is often talked about as a good idea as part of design and project resolution, and sometimes required by clients or contractors for testing and verification, we know that getting it right can be complicated.

Why we Created this Guide

This document distills decades of experience from Arkit and our journey in developing, testing, and delivering prefabricated building systems at a range of scales, types and applications. The purpose is to share these lessons to help others in the industry - from architects, engineers, contractors, manufacturers and clients - to innovate more effectively.

A Foundation in Experience

To find truly innovative solutions that solve problems and deliver value to clients and their projects, digital & physical prototyping is critical. We know this intimately - we've been prototyping since 2008.

The Evolution of Expertise

Arkit started with an idea - to provide high-quality, beautiful architecture using a standardised design and building system to provide certainty around quality, labour, materials, process and cost. This resulted in our first project - The Bath House - both a test and place to reside which informed the development of our systems and practices.

Arkit's approach to prefabricated construction combines design precision with practical adaptability. From compact urban sites to complex logistics, we maintain the same focus on design quality and build performance.

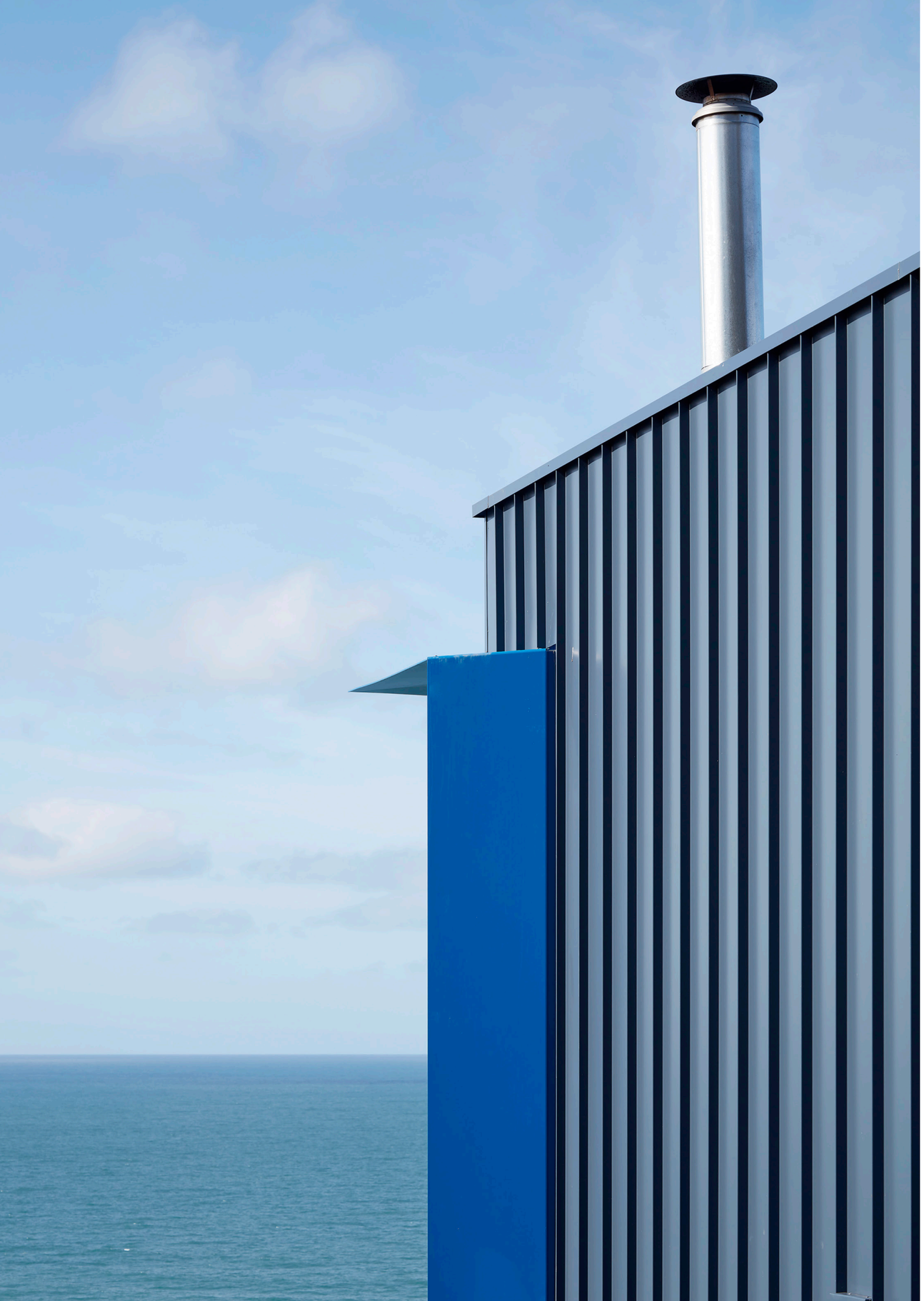
Within our purpose-built workshop, we develop and fabricate projects from the ground up, refining every detail to ensure the design intent is carried through to construction. By keeping design and manufacturing under one roof, we deliver prefabrication that is efficient, coordinated and true to the

Prototyping as a Core Competency

To date, we've completed dozens of effective prototypes - from small scale, workshop-made assemblies, components and test-fits, through to 1:1 scale buildings using a variety of materials including mass timber.

We always start digitally. Our digital fabrication team derives data and requirements from the prototype plan and purpose and creates high-fidelity drawings - usually with the support of expert supply chain partners. Sometimes the digital process is enough, but more often than not moving the digital into the physical realm allows us to test fit and tolerance, environmental influence and impacts, physical dimensions - weight, height, width, logistics, lifting, transportation, movement and stresses.

Most importantly, our controlled environment, knowledgeable team and creating feedback loops generate scalable network effects that translate to higher quality outcomes and better buildings for our clients.



The Prototyping Framework

There is no successful prototype without a defined purpose. It has a functional role in removing uncertainty in design, construction or some other requirement. Start first with the problem to be solved and develop a framework for evidence-based decision making - we can co-create this with you.

Defining Success

To make a successful prototype, it has to demonstrate a response to a known problem. We move beyond simple “go/no-go” outcomes. A successful prototype provides clear data, validates assumptions, and refines a pathway forward, even if the result is to pivot or abandon an idea.

Solving Pain Points

Some of the common industry challenges that prototyping can address can include the following:

- Sources of unknown costs e.g., is time, complexity, serial trades or some other factor driving excess costs in what appears to be on paper a simple exercise?
- Unproven performance claims - a supplier may claim benefits on paper, but how to meaningfully demonstrate this in the context of a specific project?
- Inefficient onsite construction - are complex installations, poor scope or inadequately-scoped workflows and demarcation driving waste and in turn being amplified across entire building or work faces?
- New components, materials or assemblies - want to try something new but need testfit and verification
- Product Development - does my idea have advantages over a baseline approach? How can we test this?
- Interfaces between building systems e.g. between a facade and a floor that might be complex, novel or require refinement
- Environmental risk - what does a part, assembly or other physical element look like after exposure to weather, rain, or some other factor?
- Quality measures - often driven by user experience as much as regulatory requirements e.g. testing a user’s reaction to floor vibration and feel (longer span floors or new floor composites), acoustic qualities, finishes and selections will be as much a subjective as an objective test
- Client and end user verification - what does a part look like, what does a finish feel like, what are

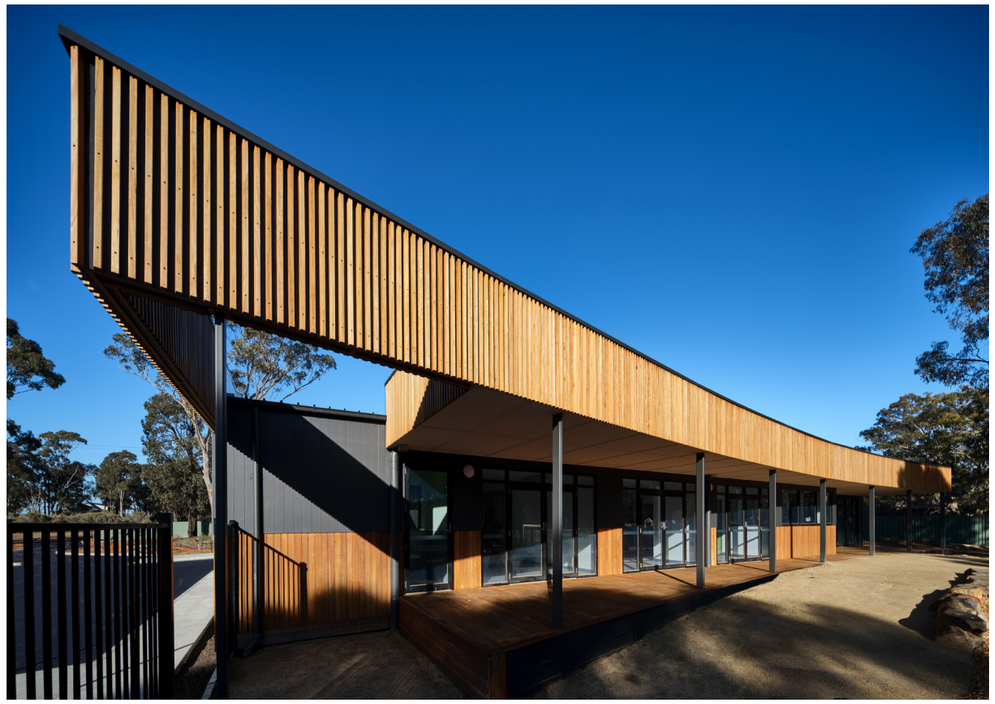
What do you mean by Requirements?

In the context of developing a construction prototype with an MMC lens, ‘requirements’ are the set of specific, measurable criteria that the prototype must meet to prove its viability as a repeatable **product**, not just a single dead-end exercise.

This is a fundamental shift from the traditional construction mindset, which focuses on project-specific requirements like on-site assembly instructions or a one-off structural design.

Here’s a breakdown of what that means:

Traditional Project Requirements	Product Development Requirements (with an MMC Lens)
Focus: Building a single, unique structure.	Focus: Creating a repeatable, scalable, and manufacturable system.
Example: A specific wall detail for a particular corner of a building.	Example: A panelised wall system designed for offsite fabrication with a specific tolerance range (±2mm) that can be duplicated across projects.
Outcome: A successful project that is delivered on time and on budget.	Outcome: A validated product that is ready to be manufactured and deployed on multiple projects.



Key Categories of Requirements for a Prototype

Requirements for an MMC prototype extend beyond the final building’s performance to include its entire lifecycle, from design to production. They can be broken down into the following categories - note that some of these requirement categories will need 3rd party definition, assessment, verification and validation (if required):

Performance Requirements:

- These define what the product must achieve in its final state. This includes structural integrity, thermal and acoustic performance, fire resistance, and durability. For example, a requirement might be for a wall system to achieve an R-value of 4.0 or a specific acoustic rating (Rw+Ctr) to meet building codes.

Manufacturability Requirements

This is a crucial aspect of the MMC lens. It focuses on how efficiently the product can be made in a factory. This includes:

- Tolerance and Fit: How precisely components must be manufactured to ensure a perfect fit on-site.
- Assembly Efficiency: The number of hours required to assemble a module or component in the workshop.
- Material Optimization: How to minimise waste and material types.

Scalability Requirements:

These requirements determine if the prototype can be ramped up for mass production. They include the availability of materials, the reliability of the supply chain, and the ability to vary the product to meet different project needs without redesigning it from scratch.

For example, a system might be designed to allow for module size variations in 600mm increments or some other spatial/structural system. From a design perspective this might be achievable, but in practice this could have flow on effects to interfaces, material selection or some other factor that drives waste and might not be able to be predicted accurately in the digital realm.

Regulatory Requirements:

This involves proving that the system complies with all relevant building codes and standards. The prototype must demonstrate compliance with the Building Code of Australia (BCA) and other regulations through testing and evidence.

Market & User Requirements:

These focus on the end-user and market appeal. The prototype must validate that the system is desirable, functional, and meets the needs of its intended market, such as a developer aiming for low-cost housing or a homeowner seeking a sustainable option.

The Prototyping Plan

All of the above needs to go into a specific prototyping plan that is agreed by all stakeholders and signed off in advance - we can help with this.

Categories of Prototyping

Category selection is critical - without knowing and strictly defining the category, a prototype can fail. If designed for one category but scope changes or increases to provide results from another category type, it may end up not delivering the desired results and prove to be a wasteful exercise. Here are the main categories:

Project Prototypes (to validate a specific project design)

To de-risk a one-off or limited-run building design, ensuring that the design intent can be successfully translated into a physical outcome.

Key Focus Areas:

- Design Validation: Confirming how a design's aesthetics and functionality translate to the physical world.
- Contractor & Assembly Validation: Testing the efficiency and sequencing of assembly to inform construction planning.
- Tolerance & Interface Testing: Ensuring different components and materials fit together as designed.

Product Development Prototypes (to create a repeatable product)

To develop a new building system or component that can be consistently manufactured and deployed across multiple projects.

Key Focus Areas:

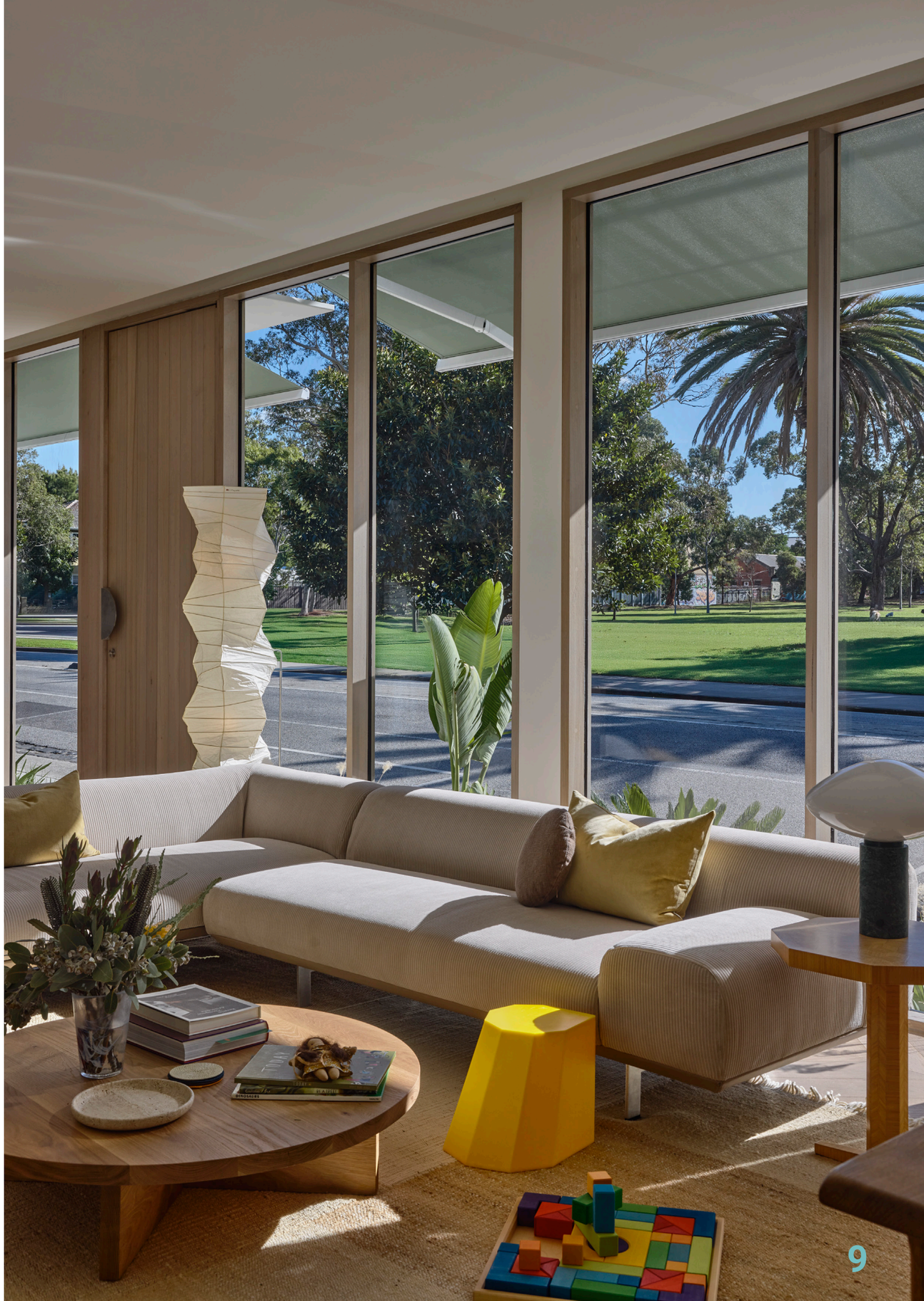
- Digital Simulation & Analysis: The role of digital tools in identifying potential issues before physical production.
- Physical Prototyping & Load Testing: Using physical models to verify performance claims under controlled conditions.
- Supply Chain Optimization: Engaging with suppliers early to ensure a reliable and cost-effective supply chain.
- Scalability Assessment: Proving that the product can be manufactured and deployed at scale.

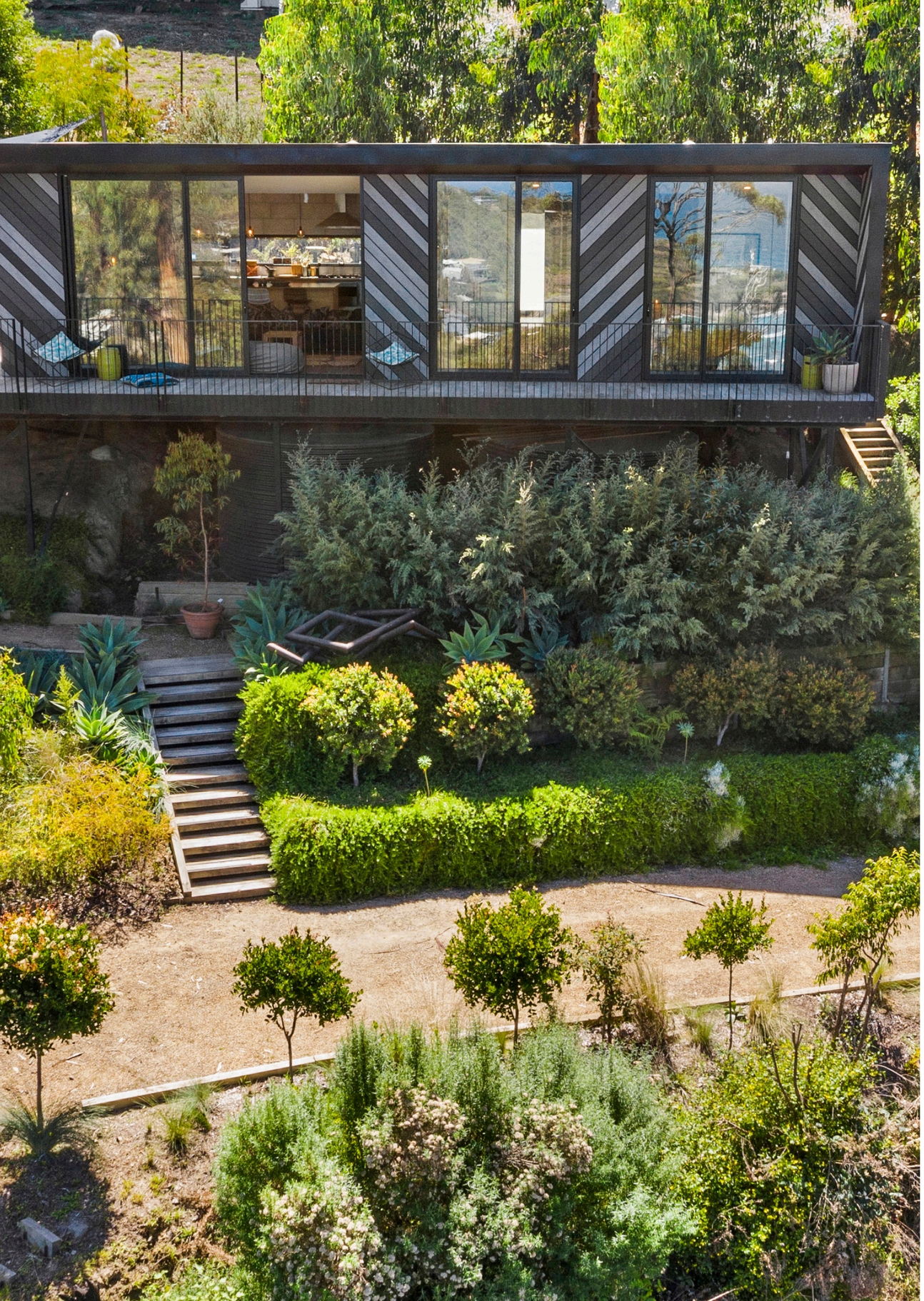
Demonstration Prototypes (to engage stakeholders)

Purpose: To create a tangible model for communicating a design or product's value to the public, investors, or potential clients.

Key Focus Areas:

- Market Feedback & Usability: Gathering real-world feedback on the design and functionality.
- Sales & Marketing: Using the prototype as a powerful tool to showcase an idea and build confidence.





The ‘Second-Life’ of a Prototype

We have a favourite saying - there is nothing more permanent than a temporary building.

If there is no plan for the prototype beyond the test, it is likely that it will end up in storage, a skip or some other place. If a key purpose of prototyping is to eliminate waste, having the prototype being the waste is not acceptable.

Planning for the Post-Prototype Phase

We don’t do any prototype unless there is a plan for its second life As experts in Design for Manufacturing, Assembly and Disassembly (DfMAD), we know that it is the last letter that is the most important.

The second life of a prototype depends on the prototype itself - we have prototyped buildings that have ended up being donated to charities or sold to buyers. Some non-habitable structures have been disassembled with materials salvaged, stored and reused.

What we do know, is that finding post-test uses and recipients of any prototype is not easy. You might have a building you think is worth keeping, selling or donating, but if the second-life recipient if not predetermined and committed as part of the plan, then there is no complete plan.

Sustainable Second Life Pathways

When planning options consider permanent installation, repurposing components, or responsible disposal and recycling, and alignment with modern, low-carbon building principles. If there is a good cause aspect to your goals, finding the right recipient is key, and as early as possible.

If there are no other options for a second life - due to destructive testing for example, disposal may be the only option.

Know all of this ahead of time and register in the Prototyping Plan.

The Prototyping Ecosystem

Digital first, physical second - ultimately, the space, funding, tooling, materials and everything else that is needed needs to be known - we can help define.

Essential Resources:

Detail the core components of a successful prototyping program, using Arkit/Multikit's facilities as a best-in-class example. This includes:

- **Space:** The need for dedicated, controlled workshop facilities.
- **Tooling & Technology:** The importance of specialized equipment and digital modeling software e.g. time and motion capture, checklists, health & safety and other critical management practices
- **Skilled Labor:** The expertise required from designers, engineers, and fabricators, intellectual property, legal and accredited testers, scientists etc.

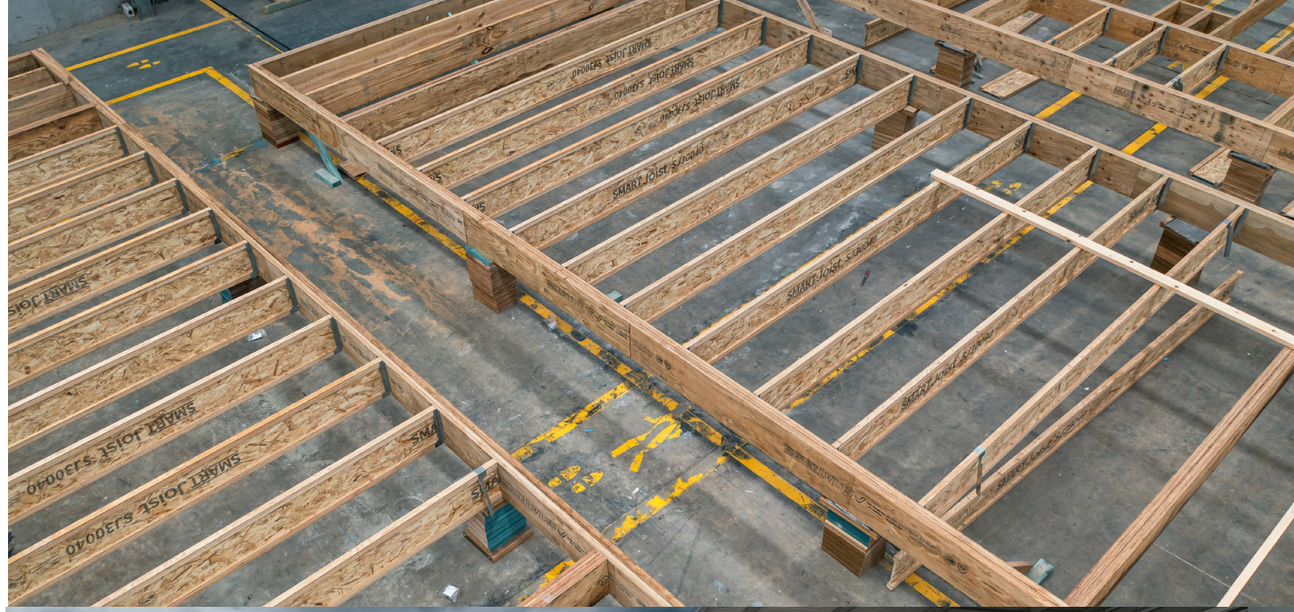
Confidentiality and Intellectual Property

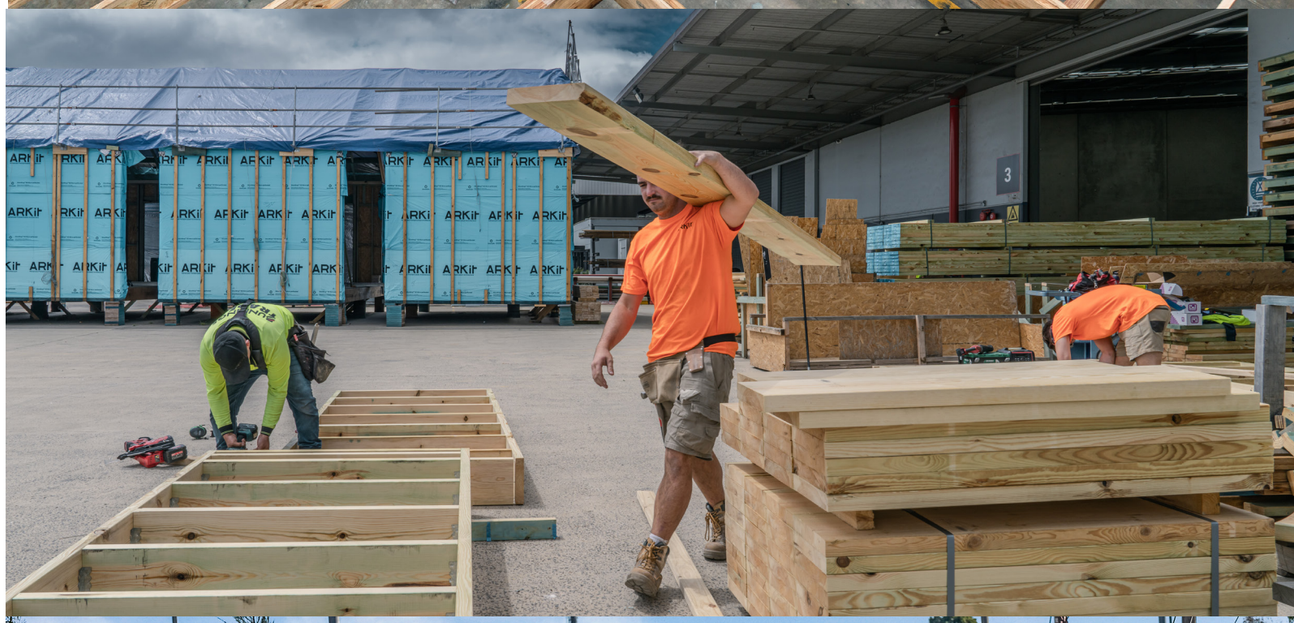
This as a key consideration for any company engaging in prototyping. Defining firstly if there is any relevant existing or background intellectual property, anticipating whether IP will be developed as a course of the prototyping process, or whether in reality there is no meaningful IP to seek or gain needs to be understood.

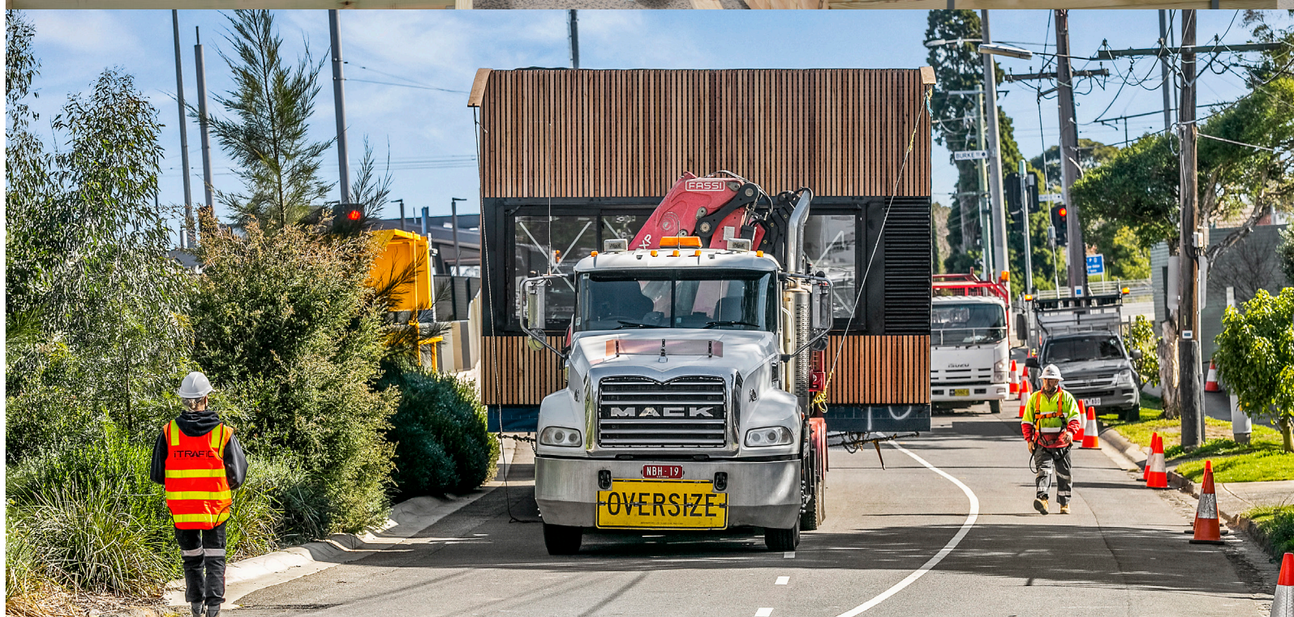
Typically, Arkit's internal prototyping work is not driven by IP development but work and fabrication refinement and improvement - we have no internal IP or commercialization capability

If there are is the potential for IP development - determined by the client and its representatives, the importance of non-disclosure agreements and clear IP ownership from the start needs to be understood and made clear as part of the plan.

Note - Arkit is not an accredited testing laboratory or have any regulatory standing in terms of product verification. When we need to, we work with accredited 3rd parties to supply these services. Our best work comes from hands-on experience and testing.





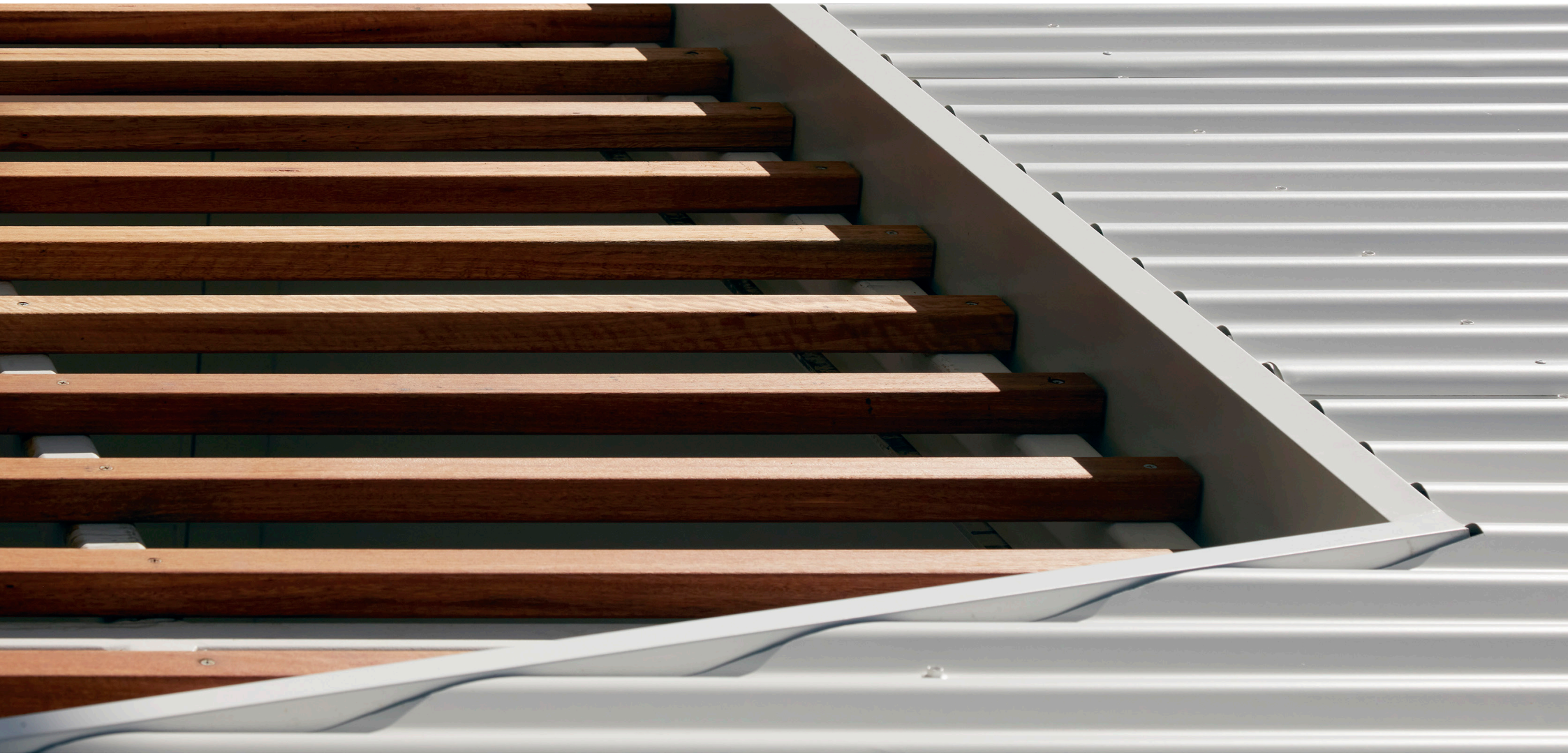


Conclusion & Next Steps

Prototyping done well provides critical advantages for clients across many domains. The key is to solve for the right problems, pick the right category of prototype, understand the right requirements, setting and capabilities required.

Summary

- **Prototyping as a Strategic Advantage:** a disciplined prototyping process is not just about testing, but about building a strategic advantage in a competitive market.
- Arkit has the expertise and facilities to assist you in your prototyping work as a service and can help you develop a specific prototyping plan to meet your needs
- **Contact:** For those interested in further consultation, contact **prototyping@arkit.com.au** to learn more



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