Design for Renovation, The Bicentennial Home:

Strategies For Long-term Relevance Through

Timeless Design and Adaptive Renovation

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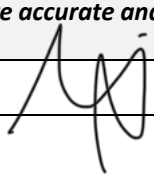
Student Name: **Taimana J Palmer**	**Signature:**		**Date:** **30/03/2026**

Abstract

The Bicentennial Home: A Vision for Sustainable, Adaptable Architecture

As Aotearoa approaches two centuries of nationhood, the state of our housing and urban infrastructure raises a forward-looking question: what should the next two centuries of domestic development look like? Building homes to last two hundred years might seem ambitious, but global examples show buildings that have been renewed, repaired, and adapted across generations. Aiming for a bicentennial outlook encourages architects, planners, and builders to consider more than just material durability; it also pushes them to think about the ability of homes to be maintained, modified, and upgraded as technologies, climates, and social norms evolve. This perspective directly affects urban resilience and sustainability, particularly given Aotearoa's trend-driven building culture.

New Zealand's dominant housing model, primarily post-war stick-frame suburbs renewed through cyclical demolition and rebuild, generates significant construction and demolition waste streams, entrenches inefficient land use, and hinders the densification necessary for creating compact, low-carbon cities. Introduced during a consumerist era, this commodity-focused mindset diverges from vernacular traditions where buildings were designed to be legible and repairable by their occupants and communities. Modern practice too often results in homes that are short-lived, rigid, and reliant on specialists.

This thesis promotes "design for renovation" as a primary goal rather than a secondary concern. It distinguishes enduring human needs (comfort, privacy, flexibility) from fleeting trends that quickly date. It also frames repairability, effective use of modularity, and accessible service layers as tools that empower households while reducing environmental impact. The conceptual approach draws on right-to-repair principles, adaptive reuse, design for disassembly and access, and material continuity or substitution, aligning with values of kaitiakitanga and whakapapa. Methodologically, the project combines literature review and precedent analysis to develop The Bicentennial Home: a practical framework and brief manual that translates principles into actionable details. The goal is to support sustainable urban growth, cultural continuity, and durable, adaptable homes that remain meaningful across multiple generations in New Zealand.

Contents

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Finally, I am grateful for the quiet guidance of faith that has accompanied this journey, a reminder that the work of building, caring for, and stewarding the world around us sits within a much larger story than our own.

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Glossary

Adaptive Reuse

Continued use of an existing building through renewal, reconfiguration, or change of programme. In this thesis, it extends repair logic to the scale of the whole building, prioritising retention over demolition.

Bicentennial Home

A conceptual framework developed in this thesis as a temporal lens for testing housing longevity. It does not guarantee a 200-year lifespan but disciplines design decisions toward intergenerational repairability, custodianship, and renewal.

Brand's Shearing Layers

A theory by Stewart Brand describing buildings as layers with different rates of change. This thesis adapts the model to distinguish slow layers (structure, primary envelope) from fast layers (services, fit-out).

Building Logbook

A durable record accompanying a dwelling over time, including drawings, specifications, and maintenance information. While analogous to building manuals and asset records, it is proposed here as a continuous, owner-accessible document supporting knowledge transfer across ownership cycles.

Cross-Layer Repairability Index

An evaluative framework developed in this thesis (Section 2.14) to assess repairability across structural, envelope, service, and fit-out layers, testing accessibility, reversibility, openness, and documentation continuity.

Custodianship

An ethic of ongoing care in which occupants act as stewards. Housing is treated as an intergenerational responsibility rather than a short-term commodity.

Design for Disassembly (DfD)

A design approach enabling buildings or components to be dismantled without damage. In this thesis, it is reoriented toward renovation and in-life repair rather than end-of-life recovery.

Design for Renovation (DfR)

A concept developed in this thesis extending repairability beyond detailing to include cultural participation, regulatory pathways, tenure structures, and long-term maintenance.

DIY Culture (Number 8 Wire Ethos)

A cultural tradition in Aotearoa New Zealand characterised by improvisation and hands-on maintenance. In this thesis, it supports homeowner–building symbiosis when buildings remain legible and workable.

Durability

Within the New Zealand Building Code, durability refers to maintaining performance over time. This thesis extends it to include cyclical maintenance and renewal.

Fast Layers

Components with short service lives, including services, finishes, appliances, and fit-out, intended for accessible replacement without disturbing slower layers.

Kaitiakitanga

A Māori principle of guardianship. It provides the ethical grounding for long-term repairability and intergenerational care.

Layer Separation

Distinction between elements that endure and those expected to change, preventing renewal of fast layers from compromising slower ones.

Legibility

The extent to which construction systems are understandable to occupants and trades, enabling maintenance without unnecessary demolition.

Like-for-Similar Substitution

Replacement with a compatible product that maintains performance when the original is unavailable, avoiding strict brand dependency.

Material Continuity

The capacity for compatible substitution over time without loss of structural logic or identity.

Modularity

A strategy based on interchangeable units. In this thesis, it is distinguished from repairability and primarily applied to fast layers.

Open Interfaces

Connections defined by dimensions and performance rather than proprietary systems, adapted here to support substitution and avoid product lock-in.

Over-Professionalisation

The transfer of minor repair tasks to licensed specialists due to integrated or proprietary systems, described here as a condition that reduces everyday maintenance capacity.

Repairability

The capacity for localised maintenance or restoration without systemic disruption, prioritising repair in place over replacement.

Reversible Fixings

Mechanical connections that allow components to be removed without damage.

Sealed Systems

Assemblies relying on irreversible bonds or concealed fixings, limiting selective repair.

Slow Layers

Elements with long service lives, including structure and primary envelope, intended for preservation through localised repair.

Symbiosis (Homeowner–Building Symbiosis)

A reciprocal relationship between legible buildings and active occupants, enabling ongoing maintenance and adaptation.

Temporal Horizon (Two-Century Horizon)

A methodological device used in this thesis to test whether design can support multiple cycles of renewal beyond a single ownership lifespan.

Trend

A short-term stylistic or technical shift lacking long-term adaptability or repairability.

Whakapapa

A Māori principle of genealogical continuity linking people, place, and built form, framing buildings as part of an ongoing lineage.

Chapter 01: Introduction

01.00. Background

01.00.1. Global Decline in the Longevity of Housing and the Shift to Housing as a Product

In many countries, the lifespan of housing is decreasing while the environmental impacts of construction and demolition rise (Allwood et al., 2011). The use of sealed assemblies, proprietary profiles, and brand lock-in makes selective repairs increasingly unfeasible or technically impossible. This trend shifts practice toward replacing entire units and consolidates control within supply chains rather than in households and local trades (Durmišević, 2019). Buildings are now viewed less as evolving artefacts and more as disposable products. Consequently, the traditional knowledge and agency involved in daily maintenance have been replaced by reliance on proprietary systems and centralised control of production.

The global right-to-repair movement offers a valuable perspective for understanding this change. Fundamentally, it advocates for access, transparency, and owners' ability to understand and maintain their possessions (iFixit, 2010). Applied to architecture, this view challenges the idea of homes as fixed commodities, instead seeing them as long-term partners that require understanding, care, and periodic maintenance.

On a global level, however, housing systems tend to drift in the opposite direction. Industrialised construction and standardised supply chains promote integrated components that cannot be opened, repaired, or upgraded on site. Local failures then often lead to complete replacements, which increase lifecycle carbon emissions and generate more waste (Durmišević, 2019; Allwood et al., 2011). Financialization encourages rapid refresh cycles at the expense of long-term durability, fostering a market tendency that prioritises exchange over endurance (Aalbers, 2017). In these systems, the everyday work of maintenance is undervalued, despite its critical role in environmental sustainability and the continuity of cultural preservation.

Historical examples show what is at stake. The Nakagin Capsule Tower in Tokyo aimed for renewal through modular replacement but failed when industry commitment to compatible parts waned, illustrating that technological flexibility without cultural continuity leads to early obsolescence (Lin, 2011). In contrast, typical historic housing in many cities has lasted centuries because its components are simple, removable, and easy to understand, with maintenance knowledge shared within communities rather than controlled by brands (Feilden, 2003).

01.00.2 Local Conditions In Aotearoa

Aotearoa's housing scene reflects global pressures but is shaped by local material, cultural, and regulatory factors. Since the mid-20th century, lightweight timber has been the primary choice for homes. However, it faces increasing criticism due to limited durability and poor adaptability (Schrader, 2005). Features like concealed fixings, thin claddings, and sealed joints complicate repairs, making incremental updates difficult and leading to a preference for complete replacements (Hunn et al., 2002). This has fostered a building culture that views homes more as short-term assets than enduring, intergenerational landmarks.

The leaky-homes crisis clearly highlighted these vulnerabilities. Failures in proprietary or in accessible wall systems, untreated framing, and hidden junctions turned local issues into widespread decay, leading to billions in repair costs and exposing the industry's dependence on brand-specific products (PricewaterhouseCoopers, 2009). When inspection and repair methods are excluded from design, maintenance becomes unpredictable, costly, and easily deferred.

Local cultural frameworks provide an alternative perspective. Key concepts in Te Ao Māori, including kaitiakitanga, whakapapa, and manaakitanga, affirm a worldview where people, land, and built environments are interconnected through continuous relationships of care and reciprocity (Royal, 2012). In this context, a dwelling is considered a taonga, entrusted to the present for future generations. Maintenance and repair are seen as responsibilities that preserve both material and genealogical connections continuity.

Aotearoa's DIY traditions reflect a similar trend. Historically, from early settler cottages to post-war state houses, accessible methods encouraged occupants to personally modify and maintain their homes (Schrader, 2005). However, as systems grow more complex and proprietary, this hands-on involvement has declined. The rise of professionalisation has further distanced residents from their buildings, shifting responsibility to contractors and eroding the social foundation of maintenance.

Economic and governance factors exacerbate the issue. The financialisation of property transforms housing into an investment asset, emphasising quick turnover and short refresh cycles instead of long-term functionality (Aalbers, 2017). Brief tenures and high mobility weaken motivations to maintain or upgrade homes, while rental markets often create split incentives- landlords incur costs while tenants benefit.

01.00.3. Response to The Challenges

This thesis addresses the increasing disposability of housing by proposing a framework that emphasises renovation as the key to architectural continuity. It suggests that durability in architecture is not solely based on material permanence but on the ability of social, cultural, and technical systems to foresee change and stay receptive to renewal.

The research promotes a core ethos of custodianship, redefining ownership as stewardship. It suggests that buildings are shared inheritances passed down through generations, not just consumable resources. This approach views repair as an active way of engaging with a building's continuous life, linking individual responsibility with environmental care, community involvement, and resilience.

The thesis ultimately seeks to establish a housing model centred on inhabitant involvement. This approach views care, adaptation, and renewal as respectful responses to both physical materials and memories. It suggests that genuine sustainability relies not on resisting change but on designing spaces that can adapt over time.

01.01. Research Motivations

Aotearoa New Zealand's housing is becoming more disposable, just as long-term care is most urgent. Homes are lasting fewer years while the costs and impacts of demolition and replacement climb. Locally, habits of lightweight, tightly sealed, proprietary construction have normalised complete replacement, sidelined maintenance know-how, and reduced the agency of inhabitants. This is a cultural shift that treats houses as market products rather than places to be kept in service over time.

The right to repair reframes the inhabitant's role by asserting that people should understand, maintain, and renew what they own. In architecture, this means dwellings remain legible to their custodians. Repair becomes a continuing relationship between people and fabric. Value grows through cycles of care, adaptation, and renovation. This is in alignment with Te Ao Māori principles of Kaitiakitanga and whakapapa. A house is a taonga held in trust, and maintenance is an ethical duty.

History shows that durable homes endure because they adapt. Vernacular cottages, villas, and Japanese townhouses have been extended, subdivided, and reconfigured as needs and techniques changed. Their identity holds through continuity of logic rather than the materiality of parts. Houses last where inhabitants act as custodians, where knowledge is shared communally and intergenerationally.

Enduring needs outlast fashionable fads. Homes at their core offer comfort, privacy, adaptability, and connection to whanau, community and whenua. Fashions turn quickly, and when design follows fashion cycles, homes quickly become outdated and lose value. When design anchors to enduring needs and allows low-risk change at the edges, taste can move on without demolition.

This logic hits hard limits in our cities. Construction and demolition waste fills landfills, and embodied carbon increases whenever replacement becomes cheaper than renovation. However, in this cycle, mass demolition is necessary; our suburban fabric sits uncomfortably with the densification now needed in our cities and towns. New Zealand needs these new, denser developments not to continue the cycle where

fragile houses discourage care, neglect accelerates obsolescence, obsolescence justifies demolition, and demolition leads to more used and discarded resources.

Economics and institutions amplify this loop; the financialisaton of housing rewards quick refresh and exchange value over serviceability. Dropping rates of owner-occupier and split incentives for rented homes sidelines repair and actively prevents upgrades. Performance-based codes are often treated as one-off hurdles at first build, with little weight on legibility, access, or future substitution.

01.02. Research Question

The central question of this research is:

How can homes in Aotearoa, New Zealand be designed for renovation and maintenance across generations by integrating right-to-repair principles, an owner-led symbiotic DIY custodianship culture?

This is supported by two further questions:

And what insights can be drawn from the evolution of dwellings, lessons from historic homes and their refurbishments, and clear criteria that distinguish enduring needs from transient trends?

All while contributing to sustainability over the building life cycle and aligning with Te Ao Māori and current Kiwi values.

01.03. Problem Statement

The modern housing situation in Aotearoa is marked by disposability. Demolishing and replacing buildings have become routine solutions for ageing structures, resulting in substantial volumes of construction and demolition waste. This reveals a construction culture that emphasises speed, cost, and immediate compliance rather than adaptability, repair, and sustainable management.

This condition is not tied to a particular construction period but rather arises from post-war building principles that continue to influence housing today. Technologies such as lightweight framing, sheet materials, layered envelopes, and specialised junctions were developed for quick, standardised construction and have been repeatedly used over decades. Although these systems enable fast delivery, they are seldom designed for use across multiple generations. As technical complexity has grown, many houses have become less adaptable for modifications or repairs without significant effort.

At the urban scale, this logic has significant consequences. Housing forms shaped by low-density planning and car-oriented infrastructure remain difficult to intensify, even as cities are pressured to grow inward.

When dwellings cannot be adapted to new household structures or higher densities, redevelopment often involves complete replacement rather than cumulative improvement.

A tension therefore exists between density and repairability within the housing stock. Many older housing forms, such as villas, bungalows, and early state houses, are spatially inefficient and poorly suited to contemporary density targets. Yet they often retain a high degree of repairability. Simple structures and accessible assemblies allow components to be replaced, extended, or altered incrementally. By contrast, much contemporary housing is explicitly designed to deliver higher density but inherits the same fast-build logic in intensified form. Layered envelopes and tightly integrated systems make buildings difficult to access, modify, or partially repair. When failures occur, intervention is typically extensive, specialist-led, and costly.

This creates a fundamental challenge for New Zealand's densification trajectory. As cities become denser, the cultural and environmental importance of repair increases rather than diminishes. More intensive housing concentrates materials, energy, and social relationships. In this context, repairability is not a secondary concern but a prerequisite for sustainable densification.

At the individual level, disposability is often reinforced by limited repair options. Homes designed with minimal durability and sealed systems discourage ongoing maintenance when repairs become difficult or expensive. Conversely, environments that allow for modifications and regular upkeep generally encourage longer stays, stronger emotional ties, and a greater willingness to invest in care. The traditions of collective and intergenerational housing in Aotearoa demonstrate how flexibility and shared responsibility can help sustain both buildings and communities across generations.

Despite these examples, the current regulatory and professional focus still emphasises performance during construction rather than long-term serviceability. Repair and renovation are often treated as reactive measures rather than integral design features. Consequently, housing systems find it difficult to accommodate staged updates or significant user-driven changes.

The core issue isn't about material selection or the buildings' construction dates. Instead, it stems from a failure to view housing as a durable, adaptable framework that can evolve. Unless there is a move towards repairable, flexible, and incrementally renewable housing, New Zealand risks resource-intensive, resistant-to-change, and culturally disposable housing. In this context, longevity should be understood as the capacity to absorb change through continuous maintenance, adaptation, and renewal, rather than as resistance to change.

01.04. Aims and Objectives

This thesis seeks to reframe housing in Aotearoa New Zealand as long-lived, repairable, and adaptable by positioning the inhabitant as a custodian rather than a consumer. Its central claim is that housing longevity is achieved through a symbiotic relationship between the home and its occupants, in which buildings are designed to invite care, repair, and modification, and dwellers are able to respond to change through ongoing stewardship.

In developing this position, the thesis challenges assumptions embedded in contemporary housing practice, particularly the widespread characterisation of modern, and largely non-repairable construction as a continuation of "traditional" building methods. The research argues that this association is misleading. What is often described as traditional construction is more accurately understood as a post-war, efficiency-driven approach that prioritises speed of assembly and short-term performance over repair, renewal, and long-term care. In contrast, genuinely traditional housing practices, both in Aotearoa and internationally, have historically relied on repairable materials, accessible construction systems, and accepted cycles of maintenance and adaptation.

The thesis draws on principles of kaitiakitanga, contemporary right-to-repair discourse, and the observed evolution of dwellings over time to demonstrate that long-lasting housing has always been shaped through use rather than completion. By contrasting these practices with modern construction systems, the research shows how contemporary housing has diverged from, rather than inherited, traditional building knowledge.

This divergence is examined through drawings and analyses of housing that has evolved through successive acts of repair, extension, and reinterpretation, alongside housing destined for demolition because they were not designed to be repaired or adapted. These examples are selected to reveal how design decisions shape whether a building accumulates value over time, or becomes disposable once its initial performance declines.

Repairability is therefore positioned as both a technical and cultural issue. The environmental costs of demolition and replacement are inseparable from cultural attitudes toward maintenance, care, and responsibility. Density itself is not the source of disposability. The challenge lies in construction systems that limit access, repair, and incremental modification. When higher-density housing is delivered through non-repairable assemblies, failure incurs greater environmental and social costs because more people and materials are affected simultaneously.

Rather than proposing a stylistic return to the past, the research treats traditional housing as a source of principles rather than forms. It seeks to identify enduring human needs and distinguish them from transient

architectural trends, thereby protecting the fundamental while allowing flexibility in change. These ideas are developed through analysis of materials, housing typologies, and regulatory conditions.

01.05. Scope and Limitations

01.05.1. Scope

This thesis is situated within architectural theory and design research concerned with housing longevity in Aotearoa New Zealand. Its scope centres on residential architecture and on the examination of how dwellings can be conceived as long-lived frameworks that accommodate repair, renovation, and change over time. Historical and contemporary examples from both Aotearoa and international contexts are examined to identify architectural principles that support repairability and long-term adaptability.

Within this scope, the study examines the relationship among construction systems, resident involvement, and the capacity for ongoing care. Rather than prioritising optimisation at the point of completion, the research examines how housing can remain legible, serviceable, and open to incremental change across multiple generations. As part of this inquiry, the Bicentennial Home framework is developed as a conceptual device to synthesise and articulate the research findings. It is used to explore how principles of repairability, custodianship, and adaptability can inform architectural thinking, without resolving these ideas into a fixed design proposal or prescriptive model.

01.05.2. Limitations

This thesis is positioned as theory- and research-led architectural inquiry. Its primary limitation is that it does not seek to produce a singular design solution, technical prototype, or optimised construction system. Instead, it operates through critical analysis, precedent study, and conceptual synthesis to examine how housing longevity and repairability can be understood, framed, and evaluated within architectural discourse.

The research does not extend to commercial, industrial, or civic building types, although some of the principles discussed may have broader relevance. The methodology is qualitative and interpretive rather than quantitative. The thesis does not include performance modelling, lifecycle cost analysis, or detailed construction specification. Materials, assemblies, and regulatory conditions are examined with respect to legibility, accessibility, and adaptability, rather than through measured technical optimisation or compliance testing.

The thesis engages with the long term to consider housing durability; it attempts to glimpse into but doesn't claim to predict future social, technological, or environmental conditions. Any reference to extended building lifespans is therefore conceptual, used to test architectural thinking rather than to forecast outcomes. Engagement with regulatory frameworks, cultural concepts, and right-to-repair discourse is

analytical rather than empirical. The research does not include participatory studies, interviews, or policy trials, and its contribution is situated within architectural theory and design research rather than direct implementation.

The Bicentennial Home framework is presented as a theoretical construct rather than a prescriptive model. It is intended to support critical reflection on repairability, custodianship, and housing longevity, rather than to function as a technical manual or universally applicable standard.

01.06. Significance

The significance of this research lies in its challenge to the prevailing disposability of housing in Aotearoa. It reframes housing longevity as a relational symbiosis rather than a heroic technical solution, arguing that long-lived housing emerges through the ongoing relationship between dwellings and their inhabitants. Architectural design is positioned as central to enabling care, repair, and adaptation over time. In Aotearoa New Zealand, this research offers a timely critique of construction practices that prioritise speed, compliance, and replacement over long-term stewardship. By foregrounding repairability and custodianship, the thesis aligns environmental responsibility with cultural values of care, continuity, and intergenerational responsibility.

The contribution of this thesis lies in its synthesis of architectural theory, housing precedent, and cultural frameworks to clarify how repairable housing has been marginalised rather than rendered obsolete. In doing so, it contributes to architectural discourse by repositioning housing as an ethical and cultural project as much as a technical one, and by proposing repairability as a core criterion for sustainable, long-term dwelling in contemporary Aotearoa.

01.07. Chapter Structure

This thesis is structured to move from conceptual framing to analytical investigation, and from synthesis to application.

Chapter 1 establishes the research context, question, scope, and significance, situating housing longevity within Aotearoa's cultural, environmental, and regulatory conditions.

Chapter 2 develops the theoretical foundation. It examines right-to-repair discourse, layered construction theory, adaptive reuse, material continuity, regulatory frameworks, and cultural traditions including Te Ao Māori and Aotearoa's DIY custodianship. These strands are synthesised into a theory of Design for Renovation and a cross-layer Repairability Index that reframes housing longevity as a structural, cultural, and systemic condition.

Chapter 3 outlines the qualitative research approach and analytical framework. It explains case study selection, comparative method, and interpretive strategies used to evaluate repairability across different housing contexts.

Chapter 4 examines material considerations for longevity and repairability, assessing how material choice interacts with access, substitution, and renewal.

Chapter 5 situates the research within the evolution of New Zealand housing typologies, identifying historical patterns of repair and contemporary barriers to incremental change.

Chapter 6 presents case and counter-case studies that contrast repairable and non-repairable construction logics in practice.

Chapter 7 analyses these cases to identify structural, cultural, and regulatory themes that enable or inhibit long-term serviceability.

Chapter 8 translates the findings into the Bicentennial Home framework, articulating a coherent architectural logic structured around hierarchy, separation, access, material continuity, and documentation.

Chapter 9 distils this framework into a standalone manifesto, presenting the Six Commitments as a concise articulation of repair-first housing principles.

Chapter 10 concludes by reframing the research question, clarifying theoretical, methodological, and practical contributions, situating the work within existing regulatory structures, acknowledging limitations, and outlining future research pathways.

Together, these chapters argue that housing longevity in Aotearoa depends not on material permanence alone, but on architectural systems that sustain custodianship across generations.

Chapter 02: Literature Review

02.00. Introduction

This chapter examines theory, history, culture, and technique to explain how dwellings can remain meaningful, functional, and culturally relevant for over two hundred years by emphasising adaptability, serviceability, and custodianship (Brand, 1995; Chapman, 2015; Habraken, 1998; Kendall & Teicher, 2000; Vale & Vale, 1991). The review highlights a notable gap: While New Zealand housing debates concentrate on performance and emissions, they downplay the importance of repairability and access needed for multi-generational renewal within Aotearoa's seismic, climatic, and cultural context. In this thesis, repairability refers to maintaining or restoring components in place through accessible fixes, while modularity refers to the replacement of interchangeable units. These logics are complementary but distinct and are treated alongside Design for Disassembly and Design for Access as technical enablers of long life with low waste. Open, brand-agnostic interfaces and durable documentation (including building logbooks and material passports) support like-for-similar substitution over time.

The review mainly relies on peer-reviewed scholarship and staple texts, supplemented by New Zealand policy and grey literature when relevant to practice. It proposes a layered strategy where rapidly changing elements stay accessible and reversible, while slower elements are maintained through localised efforts. Additionally, it supports open, brand-agnostic interfaces and durable documentation for easy substitution over time. The argument unfolds as follows: Section 2.01 presents a Right to Repair perspective for the built environment. Section 2.02 differentiates repairable maintenance in place from modular substitution within Brand's shearing layers. Section 2.03 translates this approach into Design for Disassembly and Access, detailing reversible fixings, service zones, open standards, and documentation. Section 2.04 applies the ethic to building-scale adaptive reuse. Section 2.05 consolidates legal and policy frameworks in Aotearoa and the EU, including consumer law, Building Code durability, circular-economy frameworks, and product stewardship. Section 2.06 promotes material continuity and adaptive substitution to prevent proprietary lock-in. Sections 2.07–2.13 explore history, culture, and economics- covering domestic layouts evolution, historic repair cultures, Te Ao Māori integration, DIY traditions, stewardship, ownership, and incentives. Section 2.14 synthesises these themes into a theory of Design for Renovation and introduces a cross-layer Repairability Index for designing, consenting, and verifying practice.

The literature advocates a clear design strategy: dividing slow and fast layers for access and disassembly, creating open, creating open, interchangeable systems to avoid lock-in, and promoting a culture of custodianship. In the Bicentennial Home framework, these principles manifest as transparency, accessibility, and reversibility at each layer, supported by comprehensive documentation and open interfaces that facilitate repair and part replacement, with social-technical supports that make these principles

workable in Aotearoa's seismic and climatic conditions. These commitments are specified through disassembly testing, clear maintenance routes, and a building logbook, and are assessed using the Repairability Index outlined in 2.14 (see 2.03; 2.05; 2.06; 2.11; 2.14).

02.01. Right to Repair in the Built Environment

Across much of human history, repair was assumed. Everyday goods were repaired rather than discarded, and buildings were maintained through cycles of upkeep rather than replaced at the first sign of wear and tear. Construction cultures selected techniques with future work in mind: joints that could come apart, finishes that could be renewed, and parts that could be substituted as supplies changed. In Europe, timber frames with pegged joints and lime mortars allowed individual members to be replaced and masonry to be repointed without disturbing the entire structure, while clay tile and slate roofs were renewed piecemeal as part of ordinary household maintenance (Feilden, 2003; Cramer & Breitling, 2007). Gothic cathedrals, despite their complexity, were detailed for ongoing service, with scaffold access and replaceable stone elements that enabled continuous work by masons across centuries (Addis, 2006). In Japan, vernacular Minka used post-and-beam structures with mortise-and-tenon joinery that could be dismantled and repaired. At Ise, the ritual of periodic rebuilding formalised renewal as a cultural duty, transmitting knowledge with each cycle (Brown & Brown, 2015; Rapoport, 1969). In Aotearoa New Zealand, Māori whare were assembled from timber, flax lashings, and raupō, with an explicit expectation of seasonal upkeep. Durability came from kaitiakitanga and continuity of practice, rather than from indestructible materials (Brown, 2009; Walker, 2004). Nineteenth-century brick and stone housing followed the same logic, with reglazed windows, patched plaster, renewed slates, and repointed brickwork keeping dwellings in service for generations when routine attention was possible and expected (Cramer & Breitling, 2007). Repair was the norm.

Longevity in buildings is only ever achieved through regular maintenance and repair. No dwelling remains standing and valuable for a century or two because it has avoided failure. It survives because each failure was minor, legible, and repairable, and because people could access the fixings, understand the joints, and replace parts without compromising the sound structure. The lesson that runs through cathedrals and cottages, Minka and whare, terraces and villas, is simple. Long life is not a property of materials alone. It is the accumulation of timely repairs made possible by design, knowledge, and access.

Repair is not only ubiquitous across traditions, but also rational once materials and labour are considered over time. Periodic pointing of lime joints, reseating of slates, reglazing of sashes, and renewal of lashings all target the point of failure rather than the whole assembly. This selective logic preserves most of the embodied work already invested in the fabric and postpones the environmental and financial cost of

replacement. Across cultures, the buildings that lasted the longest were those made legible to their users and trades, not those imagined as maintenance-free.

The contemporary Right to Repair movement first emerged in response to planned obsolescence, proprietary restrictions, and limited access to spare parts, which hindered owners' ability to maintain their possessions (Goldheart, 2017; iFixit, 2010; Ölander & Thøgersen, 2014). The claim is straightforward: users should have both the legal right and the practical means to repair and prolong the life of what they own. While the debate began with small goods, the principle is even more consequential in the built environment. A home is arguably the longest-lived product most people will ever own, yet many modern houses are effectively designed as sealed systems. Services are hidden, components are glued or laminated, and proprietary products limit repair or replacement. This creates a paradox where dwellings intended to last for decades can fail early in practice because they are difficult or impossible to service (Schweber & Leiringer, 2012).

In this thesis, the Right to Repair is treated as a design lens rather than a legal slogan (legal settings consolidated in 2.05). The operative question is not only whether occupants may repair, but whether the building is made repairable in practice. That requires physical access to services, fixings, and junctions so that routine work does not require demolition. It requires reversible connections, for example, screws, clips, bolts, and dry joints, so that selective renewal is possible. It requires open interfaces specified by dimensions, tolerances, and performance rather than brand-locked profiles, so that like-for-similar substitution remains feasible as supply chains change. It also requires transparent information that accompanies the building, such as drawings, labelling, and durable documentation, often referred to as material passports, so that future work is confident and limited in scope. The difference between sealed and open can be seen in ordinary details. When a sealed double-glazed unit fails at the edge seal, the entire unit is replaced. In contrast, a timber sash can be reglazed, re-puttied, or re-weather-stripped in parts. A weatherboard can be removed and refitted without disturbing the wall, whereas a chemically bonded render cannot be detached without destruction. Reversible fixings keep minor repairs small.

Brand's account of shearing layers clarifies where repair must be easy and how buildings endure through time (Brand, 1995). Fast layers, such as services and fit-out, should be readily accessible and replaceable. In contrast, slow layers, such as structure and envelope, should be preserved through local repair rather than demolition. Open Building reaches a similar conclusion, as separating what must last from what must change, and detailing the interfaces between them, allows for change without damage to the host fabric (Habraken, 1998; Kendall & Teicher, 2000). Section 2.02 distinguishes this continuity logic, which maintains in place, from substitution logic, which replaces in kind, so that each is used deliberately within a layered design.

Repair is green in both mechanism and intent. Selective repair conserves embodied energy and reduces waste and transport. By designing for accessibility, reversibility, open interfaces, and transparent information, the dwelling remains functional after many small interventions (methods in 2.03). It also reduces transport and demolition loads by minimising waste. In the New Zealand context, construction and demolition waste accounts for over 50% of landfill by mass in several jurisdictions, so shifting from replacement to repair has immediate systemic benefits. Bringing this environmental logic forward is crucial for the argument here, and later sections expand on the sources and implications in detail. Treating repair as a capability also clarifies why apparently efficient assemblies can be environmentally and socially costly. Adhesives and laminates can speed up installation while preventing disassembly. Hidden services can simplify layouts yet make modest faults difficult to detect. Integrated units can simplify procurement yet make parts unreplaceable once a supplier changes profile. By designing for accessibility, reversibility, open interfaces, and transparent information, the dwelling remains functional even after undergoing many small interventions. The environmental outcome is fewer tonnes moved, fewer components scrapped, and longer intervals between major works. The social outcome is agency, since households can carry out modest tasks and commission focused repairs without fear that a minor defect will balloon into a major rebuild.

In Aotearoa, legibility and access matter acutely: post-war, low-first-cost construction and integrated proprietary systems often turn minor faults into "all-or-nothing" replacements (see 2.06). Extending the local capacity-design's preference for replaceable damage to claddings, linings, and services demonstrates that rapid recovery and long life are compatible (methods in 2.03). Cultural alignment with DIY custodianship is discussed in 2.11, and the legislative setting is summarised in 2.05.

Common objections to repair in housing are that it is unsafe, that modern systems are too complex, and that replacement is cheaper. Safety and licensing boundaries are handled through access design. (policy sits in 2.05). Complexity is addressed through separation and labelling, ensuring systems remain legible even when they are sophisticated. The apparent cost advantages of replacement often overlook lifecycle effects, disposal, and the loss of residual service life in surrounding materials. When the building becomes repairable, the comparison shifts from one large job to several smaller and planned ones, which presents a different economic question.

Repairability also aligns with cultural expectations in Aotearoa. A dwelling that is both legible and workable aligns with the DIY traditions and custodianship that many households associate with home. It helps democratise durability. When replacement requires proprietary systems and specialist tools, longevity focuses on areas where capital is plentiful. When details are accessible, interfaces are open, and information is transparent, households with ordinary skills and budgets can maintain homes that last. Repair becomes a practical route to equity as well as a technical route to sustainability.

To avoid remaining a slogan, the Right to Repair lens must be specifiable and verifiable; the operational criteria are set out in 2.03 and the cross-layer repairability index in 2.14, which together allow designs to be compared and improved.

For this thesis, 'Right to Repair' in housing refers to the convergence, at the building scale, of intentional layer separation that aligns with rates of change, reversible fixings, and accessible routing at points of intervention. This includes open and brand-agnostic interfaces that prevent lock-in, as well as transparent documentation that accompanies the dwelling throughout its life. A house designed on these terms is an open and serviceable system. Routine, localised work by occupants and trades can sustain relevance and performance across generations, while reducing material throughput, lowering lifecycle cost, and strengthening the culture of custodianship that allows buildings to endure (Brand, 1995; Habraken, 1998; Kendall & Teicher, 2000; Till & Schneider, 2005; Allwood et al., 2011; Feilden, 2003; Addis, 2006; Cramer & Breitling, 2007; Brown, 2009; Walker, 2004; Brown & Brown, 2015; Rapoport, 1969; Schweber & Leiringer, 2012). Having established repair as the historical norm and as a greener, agency-giving approach to long life, the following section distinguishes repairability, which maintains in place, from modularity, which replaces in kind, so that each can be used deliberately within the layered design of a dwelling.

02.02. Repairable vs Modular: Defining the Difference

Section 2.01 frames Right to Repair as a design approach based on access, reversibility, and open interfaces. In comparison, this section clarifies the two main ways in which that approach functions at the component level. It distinguishes maintenance in place from replacement in kind, allowing future sections 2.03–2.06 on disassembly, reuse, and material to be considered deliberately within the emerging framework. The goal is to clearly state the long-life and symbiotic ethos before translating it into detailed aspects.

Within architectural discourse, repairability and modularity are often treated as if they describe the same strategy for extending a building's life. Both aim to reduce waste, prolong the use of materials, and maintain the adaptability of homes. Yet they operate differently and lead to different cultural and environmental outcomes. Repairability refers to the ability to maintain, repair, or restore a component in place, preserving most of the original material. Typical work includes repointing bricks, reglazing timber sashes, reseating slates, or patching plaster, all of which maintain the assembly's integrity while addressing the fault directly (Feilden, 2003; Cramer & Breitling, 2007). Modularity means designing elements as interchangeable units that can be removed and replaced as a whole unit when they fail or become obsolete, an approach aligned with industrial standardisation and off-site manufacture (Kieran & Timberlake, 2004; Smith, 2010). Clarifying this distinction is essential for a dwelling intended to remain relevant over centuries.

Repairability is rooted in long-standing traditions of maintenance and stewardship. It assumes that parts will wear or fail and that longevity depends on servicing rather than discarding. Because repair targets the point of failure, it conserves embodied energy. It reduces material throughput, which aligns with the argument in Section 2.01 that repair is the greener route to long life (Allwood et al., 2011). It also sustains continuity of meaning. When occupants and tradespeople can understand joints and access fixings, they maintain the building's legibility and strengthen custodianship across generations (Brand, 1995; Chapman, 2015).

Modularity evolved to deliver efficiency and predictability through the use of standard parts and repeatable operations. In housing, it appears in systems such as carpet tiles that can be swapped individually, cabinet carcasses set out in standard grids, clip-fixed façade panels, bathroom pods, or volumetric room modules made off-site and installed as units (Kieran & Timberlake, 2004; Smith, 2010). The method reduces reliance on specialist repair skills and can lower short-term costs. It also appears to mesh with circular economy ambitions where standards remain stable, and components can be recovered and redeployed (Durmišević, 2019) (see 2.05).

The strengths of modularity are also its vulnerabilities. Whole-unit substitution can foster disposability when maintenance would have been sufficient, and it relies on stable supply chains and long-term product support. The Nakagin Capsule Tower illustrates this risk. Conceived as a showcase of Metabolist modularity with capsules intended for periodic replacement, it never secured the industrial commitment needed to produce new capsules. The system stalled, the building deteriorated, and it was demolished in 2022, despite its original promise of endless renewal (Lin, 2011; Anderson, 2025). The lesson is not that modularity cannot work, but that it relies on an ecosystem of manufacturers, owners, and users that must endure at least as long as the building.

This reliance on external supply distinguishes modularity from repairability. Repair draws on local skills and accessible materials, remaining feasible even when brands, profiles, or logistics change. Modularity extends life through substitution rather than preservation and can be valuable where elements have short service lives or hygiene and performance standards shift quickly. In smaller markets, where product lines and import routes are more volatile, over-reliance on specific modules can create future unserviceability if compatible parts disappear; industry work on circular construction in Aotearoa New Zealand recognises this risk and calls for open standards and recoverable assemblies to keep options open over time (Sustainable Business Network & Construction Sector Accord, 2023a, 2023b).

Cultural effects also diverge. Repair maintains continuity of fabric and tends to deepen attachment because people see evidence of care and learn how their dwelling works, which supports the custodianship described in section 2.01 (Brand, 1995; Chapman, 2015). Modularity privileges convenience and speed. It can widen

access when skills are scarce, but it can also make care more transactional and less connected to the building's material life. Neither is universally superior, but they produce different relationships between people, place, and time.

Environmental outcomes follow the same pattern. Selective repair typically has a smaller material footprint because interventions are limited to the failed components, while the rest of the assembly remains intact. Modular replacement often discards more material than necessary because entire units are substituted to address local defects, even when recycling streams are available. Over the life of a dwelling, this difference accumulates in both waste and embodied energy terms (Allwood et al., 2011; Addis, 2006).

Skills and supply are dynamic, so either logic can fail if it enables ecosystem collapses. Repair depends on the persistence of craft knowledge and parts designed to come apart. Modularity depends on production standards and manufacturer support. A robust strategy plans for change explicitly and assigns each logic where it adds the most value. The layered view developed by Brand is useful here. Slow layers, such as structure and envelope, should favour repairability so that they endure through local work. Fast layers, such as services, fit-out, and equipment, can accommodate modular substitution, which increases flexibility without compromising the host fabric (Brand, 1995; Till & Schneider, 2005; Kendall & Teicher, 2000).

For a Bicentennial Home, the practical conclusion is a hierarchy. Repair provides the foundation because it preserves slow layers, sustains cultural continuity, and reduces material throughput. Modularity is applied where lifecycles are short and replacement are expected, such as in some appliances, specific service components, and parts of the interior fit-out, provided interfaces remain open and host assemblies are protected (Smith, 2010; Kieran & Timberlake, 2004). Positioned this way, modularity becomes a tool within a repairable framework rather than a dependency that can cause the building to fail when standards and suppliers change.

The following section translates this balanced stance into specifics by outlining how design for disassembly and access makes both logics operational in practice.

02.03. Design for Disassembly and Access

Building on sections 2.01 and 2.02, part 2.03 examines the ideas of Design for Disassembly and Design for Access as ways to turn the repair theory into practice. The aim is performance-based rather than product-specific. In this thesis, the Bicentennial Home framework can be assessed against outcomes for reversibility, reachability, and selective replacement, while leaving the choice of methods open to suit the context, cost, and craft capacity (Brand, 1995; Kendall & Teicher, 2000; Durmišević, 2018a, 2018b, 2019).

Design for Disassembly is a method of treating a building as a system that can be assembled and disassembled in a known sequence. Joints can be chosen so parts can separate without collateral damage, assemblies can be layered so fast-changing elements are accessible without disturbing slower ones, and interface details can be drawn to prevent unintended bonding across layers (Brand, 1995; Kendall & Teicher, 2000; Addis, 2006; Durmišević, 2019). Design for Access complements this by providing clear service routes, explicit inspection points, and documentation that travels with the building, ensuring future work is confident and limited in scope (Kendall & Teicher, 2000; Webster, 2015).

Most published DfD frameworks have been developed to optimise end-of-life deconstruction for material recovery by professional teams within circular-economy systems. They prioritise component inventories, resale value, and dismantling sequences for specialist handlers, which is valuable but oriented to removal at the end of service life rather than to everyday change during it (Durmišević, 2018b; Durmišević, 2019; Webster, 2015). Here, the centre of gravity is different. This thesis reimagines DfD as design for renovation, privileging in-life longevity and empowering inhabitants to carry out small, continuous acts of care.

Design for renovation can be characterised by details that are clear and practical. Fixings are either visible or logically hidden and can be removed with basic tools. Sizes are flexible and not linked to specific brands. Elements that occupants are likely to service are designed so that one or two people can remove them without special equipment. Services in occupant zones have straightforward isolation points and labelled inspection hatches, and documentation clearly shows potential hazards and procedures. This aligns with Open Building's separation of layers, with flexible housing's focus on accessible service zones, and with the cultural reality that many Kiwis expect to maintain and adapt their own homes (Kendall & Teicher, 2000; Till & Schneider, 2005; Brand, 1995; Bell, 1996; Morrison, 2012; Cox, 2016; Chapman, 2015). The building logbook and materials register can serve as everyday tools rather than material bank tracking. This supports confidence and reduces the risk of minor faults becoming major issues due to a lack of information (Webster, 2015). Repairable dwellings rely on symbiotic care by their inhabitants. Minor, local interventions keep systems and the home healthy; trades are engaged only when needed. With upkeep, demolition is only required when the building no longer fits its role or location, not because it has become unserviceable. Reversible joints, clear service routes, and open interfaces enable this inhabitant-led cycle, preserving the fabric and keeping material and money flows small and local over time (Allwood et al., 2011; Vale & Vale, 1991; Brand, 1995).

This thesis discusses families of methods rather than proposing a single approach. Reversible mechanical fixings may include screws, bolts, clips, or dowels, which are sized and spaced for removal without damage. Permanent chemical bonds should be avoided where future separation is anticipated (Addis, 2006; Durmišević, 2018a). Dry construction strategies can be implemented where practical, such as weatherboards fixed to battens, screw-fixed linings instead of adhesive-set sheets within service zones, and

gasketed or mechanically compressed seals that can be undone. Wet sealants should be reserved for locations where they are cuttable and replaceable. Sequencing can be explicitly defined, allowing assemblies to be dismantled in reverse order, with designated no-bond zones at layer transitions. Standardisation is encouraged through open, brand-agnostic dimensions and fixings, ensuring that similar components can be substituted as supply chains evolve. This applies whether the element is a clip-fixed façade panel, a demountable fit-out component, or a replaceable plant module (Kieran & Timberlake, 2004; Smith, 2010; Durmišević, 2019).

A guide can sit alongside design. Rather than fixating on particular products, a project may set measurable outcomes that any compliant detail can meet. Examples include minimum clearances for service routes, maximum fastener spacings that permit removal, explicit disassembly notes on drawings, and a requirement for detail-level mock-ups to be assembled and fully dismantled at least once before approval, with photo records included in the logbook. A simple audit at handover can confirm that access hatches are present and labelled, that no-bond zones are respected, and that parts lists and maintenance intervals are recorded. These checks help keep the approach adaptable while ensuring that repairs can be carried out safely and locally (Durmišević, 2018a; Durmišević, 2018b; Allwood et al., 2011).

This aligns with New Zealand conditions. Seismic practice already distinguishes between elements that may yield and those that must not, so detailing for replaceable damage is familiar and can be extended from structures to claddings, linings, partitions, and services. After events, or at the end of service lives, work can then be targeted, quick, and limited in scope (Priestley, 1998; Brunsdon & Shephard, 1998). This aligns with emerging circular policy settings (see 2.05). At the building scale, the ethic to add, transform, and reuse rather than demolish shows how accessibility and reversibility can lift performance while keeping the host fabric in service (Lacaton & Vassal, 2015).

For the Bicentennial Home, these methods are discussed as illustrative options, and selections will be made on a case-by-case basis. The binding commitments are the outcomes. Parts come apart without damage, quick layers are accessible without disturbing slower ones, and information needed for safe intervention is always readily available. Within those constraints, designers and builders are free to choose the mix of fixings, section profiles, and service strategies that suit the budget, programme, and skill availability. This maintains the project's flexibility while promoting longevity through regular maintenance and repairs.

02.04. Adaptive Reuse as a Strategy for Longevity

If sections 2.01 to 2.03 focus on repair at the level of details and layers, adaptive reuse applies the same ethic at the scale of entire buildings. Reuse maintains the fabric in use, conserves the value stored in materials, and prevents the waste and emissions associated with demolition and rebuild processes (Bullen

& Love, 2011; Langston & Shen, 2007). In practice, this is not a minor strategy. It remains one of the few effective methods to reduce the environmental impacts of short-lived construction by preserving embodied energy and limiting material turnover over time (Bullen & Love, 2011; Langston & Shen, 2007).

The literature clearly shows that the case for reuse is also cultural and economic. Projects that maintain existing buildings tend to stabilise neighbourhoods, support local jobs, and increase property values by bringing underused structures back into everyday life (Shipley, Utz, & Parsons, 2006). They carry both memory and utility. By enabling familiar structures to adapt to new uses, communities preserve their identity through the continuity of place, which strengthens social attachment and a sense of belonging (Plevoets & Van Cleempoel, 2019).

International and local precedents demonstrate how this functions in domestic settings. The conversion of warehouses and lofts has created contemporary homes while maintaining durable industrial shells, as observed in London and Amsterdam (Heath, 2001; Langston & Shen, 2007). In Aotearoa, small timber cottages and villas that have been adapted and restored embody the same principle on a modest scale, with policy frameworks now recognising retention as a valuable civic approach (Dunedin City Council, 2021; Wellington City Council, 2025; Heritage New Zealand Pouhere Taonga, 2025a; Heritage New Zealand Pouhere Taonga, 2025b). These examples succeed where solid structure meets stewardship.

Two recurring ideas underpin this body of work. First, material durability allows reuse with minimal intervention. Brick, stone, and heavy timber can be repaired, strengthened, and re-serviced rather than replaced, keeping most of the original work intact (American Institute of Architects, 2023; Cramer & Breitling, 2007; Feilden, 2003). Second, structural and spatial adaptability ensure buildings remain responsive. Open spans, non-loadbearing infill, and serviceable detailing enable plans to adapt as needs evolve. Reversibility acts as a safeguard here. Interventions that can be undone without permanent damage preserve future options and reduce the risk of today's solution becoming tomorrow's constraint (ICOMOS, 2003).

Researchers have shifted reuse upstream into the design phase. Instead of relying on future generations to retrofit what we create today, tools like the AdaptSTAR model incorporate adaptability as a core design element from the outset, evaluating robustness, spatial flexibility, service provision, and cultural value to delay or prevent obsolescence (Conejos, Langston, & Smith, 2013). In housing, this means incorporating generous floor-to-floor heights where suitable, clear service zones, and non-structural partitions, allowing a dwelling to change functions without stripping back to the frame (Kendall & Teicher, 2000; Brand, 1995; Till & Schneider, 2005). These principles are the same ones that enable repairs. They simply operate at a larger scale. This aligns with emerging circular policy settings (see 2.05).

Within this thesis, adaptive reuse is seen as a comprehensive building approach aligned with the right-to-repair perspective. It considers demolition as a last resort and prioritises longevity through selective renewal rather than heroic preservation. The same principles apply separate fast and slow layers for access, favour reversible junctions, avoid proprietary lock-in (see 2.03; 2.06), and pass on information so future users can act confidently (Brand, 1995; Habraken, 1998; Kendall & Teicher, 2000; ICOMOS, 2003). Where existing buildings already display these traits, reuse is straightforward. Where they do not, upgrades that enhance legibility and reversibility prepare the structure for another cycle of use.

Designing new dwellings with reuse in mind closes the loop. When homes are conceived with adaptable structures, serviceable skins, and open interfaces, they can change functions or configurations without wasteful strip-outs. That is the Bicentennial Home's ambition. It does not aim for permanence through indestructible materials, but for endurance through serviceability and a culture of stewardship. Adaptive reuse, seen this way, is both proof of concept and future insurance. It shows that extended life is feasible now, and it builds the conditions for the dwelling to remain functional, meaningful, and repairable for generations to come (Plevoets & Van Cleempoel, 2019; Bullen & Love, 2011; Langston & Shen, 2007).

02.05. Legality and Policy around Repair and Renovation

This section consolidates the legal and policy frameworks that influence repairability in Aotearoa New Zealand and explains how a repair-first approach fits within existing consent, compliance, and stewardship systems. It supports the cultural and technical arguments in 2.01–2.04 and 2.06 by showing that repairability is not just a slogan outside the system but a position that can be defined, consented to, and verified within it.

New Zealand consumer law recognises longevity as a component of acceptable quality but does not establish a formal, enforceable Right to Repair. Under the Consumer Guarantees Act, building materials sold as goods must be suitable for their intended purpose and last a "reasonable" amount of time, though the Act does not ensure long-term access to parts, profiles, or technical information (Consumer Guarantees Act 1993, s 7; Consumer Guarantees Act 1993, s 12). Legislative efforts to address this gap have yet to create new rights for buildings: on 19 February 2025, the Consumer Guarantees (Right to Repair) Amendment Bill received its first reading and was referred to the Economic Development, Science and Innovation Committee; in August 2025, the committee recommended against passage, and public reports indicated it was unlikely to progress (Consumer Guarantees [Right to Repair] Amendment Bill, 39-1, 2024; NZ Gov., 2025; Smith, 2025). Meanwhile, MBIE's Building for Climate Change work has developed whole-of-life and embedded-carbon frameworks and related methodologies, highlighting a policy focus on durability, serviceability, and lifecycle accountability, even without a formal Right to Repair for the built environment (MBIE, 2020).

Durability and implied warranties. For residential building work, the Building Act implies warranties that materials will be suitable and new, and that work will be carried out with reasonable care and skill; there is also a 12-month defects repair period during which notified defects must be remedied, alongside a 10-year long-stop limitation for civil proceedings (Building Act 2004). These provisions make "serviceable-by-design" a practical way to reduce defect risk and liability over time. Where eligible, minor repairs and replacements can proceed under Schedule 1 with comparable products, subject to the technical conditions set out by MBIE (Building Act 2004; MBIE 2014a).

Within the Building Act/Building Code framework, repairability can be achieved through the existing performance system, especially clause B2 Durability. The Code establishes durability performance periods, and designing for access, selective renewal, and open interfaces is a valid way to demonstrate compliance with the requirements of the Building Regulations 1992 across those cycles (MBIE, 2025). The Building Code is performance-based; designers may use Acceptable Solutions or Verification Methods, or propose alternative solutions supported by evidence showing the design meets the relevant performance clauses (MBIE, 2021). For alterations, consent cannot be granted if performance is compromised. Section 112 applies to existing buildings, and Section 133AT pertains to earthquake-prone buildings (Building Act 2004). A repair-first approach focuses on performance outcomes rather than specific products: assemblies that are easily accessible, elements that can be removed without damage, and interfaces that remain open and are not tied to particular brands, allowing for similar substitutions over time. The technical methods and verification strategies supporting this, such as reversible fixings, service zones, no-bond interfaces, and disassembly notes, are detailed in 2.03 and 2.06. The regulatory stance is clear: nothing in the performance system prevents repairability; in fact, performance-based consenting encourages it when outcomes are clear and supported by strong evidence (Brand, 1995; Habraken, 1998; Kendall & Teicher, 2000; Durmišević 2019).

Product assurance and substitution hold equal importance. In a repairable dwelling, designers should favour specifications based on performance and dimensions rather than proprietary lock-ins, so that multiple suppliers can meet the interface requirements. When a product change is necessary because a profile is leaving the market or an equivalent with lower embodied carbon becomes available, the performance system already provides pathways to demonstrate equivalence. Building Product Information Requirements oblige suppliers to disclose performance, installation, and maintenance details; a repair-first project should have BPIR data included in the handover logbook (Building [Building Product Information Requirements] Regulations 2022; MBIE, 2023a; MBIE, 2023c). When a proprietary item is unavoidable, CodeMark or similar evidence can establish compliance while keeping the interface open for future equivalents (Building [Product Certification] Regulations 2022; MBIE, 2023b; MBIE, 2024b). Referencing open standards helps keep interfaces brand-neutral and widely serviceable; for example, NZS 3604 for timber framing (Standards

NZ, 2011). Substitutions are considered minor variations if scope and performance remain unchanged, or as amendments if they do not. Producer statements and design feature reports are common evidence pathways. They can support an application but are not warranties and cannot be mandated by law (Building Act 2004).

Licensing frameworks specify who can do what, not whether the work is accessible. Restricted Building Work must be designed and constructed by or under the supervision of Licensed Building Practitioners, while prescribed electrical and gas fitting work must be performed and certified by licensed trades (Building Act 2004). A repairable home respects these boundaries by making likely intervention points clear and safe to access: isolation valves and labelled inspection hatches at service nodes; clear separation between occupant-serviceable covers and licensed-only enclosures. The design guidance for access belongs with 2.03, while the social argument for everyday participation is covered by 2.11. The regulatory message here is that clarity and access reduce risk by making compliance easier to achieve and inspect.

Safe-by-design maintenance. Health and safety responsibilities for designers and other PCBUs extend to foreseeable use and maintenance. Providing visible isolation, fall-safe access, and labelled hatches helps fulfil these duties and makes inspections and audits easier (Health and Safety at Work Act 2015; WorkSafe NZ 2018).

Multi-unit settings. Where dwellings include specified systems, compliance schedules and annual building warrants of fitness formalise inspection and maintenance (Building Act 2004; MBIE, 2014b). Under the Unit Titles regime, long-term maintenance plans and funds can be structured to favour repair and selective renewal over strip-outs, aligning governance with the repair-first stance (Unit Titles Act 2010; NZ Legislation, 2010b; NZ Legislation, 2010a; MBIE, 2024a; MHUD, 2025).

Heritage, seismic, and waste policies all guide practice towards repairability when considered together. Heritage guidance in Aotearoa and internationally encourages compatible change and prioritises repair over replacement when performance and significance are maintained, reflecting an institutional approach like the like-for-similar substitution discussed in 2.06 (ICOMOS, 2003; Australia ICOMOS, 2013). Seismic design in New Zealand already distinguishes between primary life-safety structures and sacrificial or non-structural elements; strategies for low damage and replaceable parts naturally extend to claddings, linings, partitions, and services (see 2.01; 2.03). Waste and circular-economy policies, along with local C&D waste-reduction strategies, support selective renewal over demolition by valuing recoverability and material retention across cycles (MfE, 2023; Auckland Council, 2018). Local C&D conditions fall within the Waste Minimisation Act framework (Waste Minimisation Act 2008).

Documentation acts as the link that connects compliance to subsequent work. A "handover pack" that accompanies the dwelling, containing drawings, specifications, consent conditions, producer statements, O&M information for fixed systems, and clear labels at access points, transforms legal compliance into a practical tool for targeted intervention. European-style building logbooks and materials passports go further by organising information for future retrieval and adaptation (2.03; 2.06). In a New Zealand context, using a lightweight logbook at handover and updating it with each consented change ensures continuity, enabling future trades and owners to work confidently without needing to reopen consents for unknowns. Include statutory certificates such as electrical Certificates of Compliance and Records of Inspection, gas safety certificates, and LBP Records of Work to support future compliant interventions. Product-information compliance material can be embedded here to support future repairs and substitutions (MBIE, 2023a; MBIE 2023c).

Economic and tenure arrangements influence who is motivated to use these capabilities. Section 2.12 examines these dynamics in detail. In rental housing, a split incentive remains, where landlords bear the capital costs of repairs and upgrades, while tenants gain most of the comfort and bill savings, leading both sides to underinvest. New Zealand's approach partly addresses this through the Residential Tenancies Act's Healthy Homes Standards and the compliance-statement requirement, and Warmer Kiwi Homes co-funds upgrades for eligible owner-occupiers (Residential Tenancies [Healthy Homes Standards] Regulations 2019; Tenancy Services, 2019; EECA, 2025). These measures encourage timely, targeted repairs and fabric improvements, but gaps still exist where assemblies are sealed or proprietary, making minor fixes uneconomical. Legally, repairability works best when authority, information, and incentives are aligned. This includes long-term stewardship models such as body corporate maintenance plans, clearer landlord obligations, and practical handover or logbooks that support compliant, low-risk interventions (see 2.03; 2.06).

Finally, policy signals regarding embodied carbon and circular construction influence what is considered "reasonable" practice. If waste and emissions are tracked throughout a building's lifecycle, then designs that avoid sealed composites, enable part-level repairs, and specify open interfaces become easier to justify in consent drawings, procurement plans, and carbon reports than those relying on complete strip-outs at each refresh (Allwood et al., 2011; European Commission, 2020; European Commission, 2021; A.I.A., 2023). In this way, the legal and policy environment is already moving towards the Bicentennial Home framework: a performance-based code that promotes lifecycle policies, establishes licensing and heritage frameworks, and develops emerging documentation standards, all of which support accessible, reversible, and brand-agnostic detailing when these outcomes are explicitly articulated.

Aotearoa's current policies neither prohibit nor hinder a repair-first approach to housing. They provide practical pathways for specifying, consenting to, building, and handing over homes designed for

maintenance and adaptation over generations. Sections 2.03 and 2.06 detail these policy tools; 2.11 and 2.12 link them to culture and tenure; and 2.14 set out the metrics, including durability planning, access and maintenance evidence, product-information completeness, and governance and tenure arrangements. The law offers the framework, while repairability guides the practice.

02.06. Material Continuity and Adaptive Substitution

If sections 2.01–2.04 establish longevity through repairable detailing, selective modularity, reversible access, and building-scale reuse, this section shifts to material continuity as the complementary principle. The focus changes from how parts are disassembled to how roles can be redefined when original sources evolve. In practice, durability relies on keeping interfaces adaptable so that future builders can replace compatible materials without compromising performance or identity.

For a Home intended to last across centuries, longevity relies less on the permanence of materials than on the ability to replace parts with compatible materials that future generations can access. Buildings endure when their assemblies remain clear and separable, joints can be remade, and roles can be filled by similar substitutes as supply chains evolve (Brand, 1995; Feilden, 2003; Cramer & Breitling, 2007; Vale & Vale, 1991). Historical practice shows this is not a modern concession but the normal state of durable building cultures. In Aotearoa, many nineteenth- and twentieth-century houses originally framed in native species have been maintained with the same structural logic using plantation timbers; the shift to radiata pine in everyday construction is well documented and incorporated into local guidance and standards (Isaacs, 2009; Standards New Zealand, 2003a; Standards New Zealand, 2003b). Māori building traditions embraced cyclical renewal, with raupō and lashings replaced routinely rather than as signs of failure. Similarly, Japanese timber architecture depends on replaceable posts and beams within stable structural frameworks (Walker, 2004; Brown, 2009; Oliver, 2006; Rapoport, 1969; Young & Young, 2019). European masonry and timber traditions combine sturdy cores with repairable outer layers and fittings so that failures stay local and reversible (Addis, 2007; Feilden, 2003). Viewed this way, substitution is a key to endurance: the building remains recognisable not because its materials are fixed, but because its principles are stable and its interfaces remain open.

While twentieth-century doctrine often emphasised strict "like-for-like" replacement, contemporary practice accepts that quarries close, tree species become protected, and industrial profiles change. The Burra Charter defines significance in ways that enable compatible change when the original fabric cannot be sourced. Conservation scholarship supports "like-for-similar" substitution when it maintains performance, safety, and meaning (Australia ICOMOS, 2013; Jokilehto, 1999; Stanley-Price et al., 1996; Rodwell, 2007). In housing, this approach helps avoid false choices between authenticity and usefulness: a geologically

similar stone, engineered timber with comparable strength, or a dimensionally compatible profile can ensure continuity without relying exclusively on one quarry, one species, or one manufacturer.

New Zealand's leaky home crisis also highlights the dangers of proprietary lock-in methods. The weathertightness crisis demonstrated how brand-specific, integrated cladding systems can transform local flaws into widespread failures, leading to demolition-scale interventions where targeted repairs might have sufficed (Hunn et al., 2002; PricewaterhouseCoopers, 2009; Easton, 2010; Dyer, 2019; James et al., 2017; Mosley, 2025). More broadly, when components rely on single-supplier profiles, patented seals, or irreversible bonds, maintenance depends more on corporate stability than on building logic. A long-lasting dwelling must reverse this dependency. Interfaces should be defined by performance and dimensions rather than by brand; fixings should be mechanical and reversible; wet bonds should be limited to locations where they can be cut and replaced; and service zones should be planned for accessibility so that quick-replace layers can be renewed without disturbing slower ones (Addis, 2006; Brand, 1995; Kendall & Teicher, 2000; Kieran & Timberlake, 2004; Smith, 2010; Guy & Moore, 2005; Schittich, 2005). Durability obligations in New Zealand are performance-based (see 2.05), considering durability a performance obligation over specified life categories, ultimately fulfilled through details for access, selective renewal, and compatible materials, rather than relying on any single brand solution (Ministry of Business, Innovation and Employment, 2025).

Material passports, building logbooks, and clear as-built documentation enable future trades and occupants to confidently reproduce parts with new materials, transforming substitution from improvisation into an organised practice. Empirical studies and programmes demonstrate how passports can enhance recovery and reuse potential and guide selective interventions at the component level, while also supporting client and market acceptance (Durmišević, 2018a; Durmišević, 2018b; Durmišević, 2019; Honic et al., 2019; Webster, 2015; Allwood et al., 2011). Case examples such as the Triodos Bank "material bank" and related Dutch circular portfolios show how building-level registries and marketplace infrastructure realise these ideas in practice, linking documentation to future adaptability and asset value (Madaster, 2020; ABN AMRO Bank N.V., 2018). Parallel work on healthy, cradle-to-cradle-aligned materials libraries and design protocols indicates that open documentation can coexist with quality and well-being objectives rather than oppose them (Park 20|20, 2020; American Institute of Architects, 2023). At the detail level, circular decision-making methods already compare partition and fit-out systems on life-cycle emissions, cost, and reversibility, validating design choices that keep interventions small and recoverable across refurbishment cycles (Rajagopalan et al., 2021). In Aotearoa, transparency aligns well with DIY traditions and custodianship practices: making details understandable and methods teachable fosters democratisation of durability by lowering the skill and cost thresholds for routine maintenance (Bell, 1996; Morrison, 2012; Cox, 2016). This aligns with emerging circular policy settings (see 2.05)

A simplicity bias underpins these goals. Materials that are common, legible, and workable with basic tools. Materials such as timber, fired clay, stone, and lime possess deep reservoirs of skill and remain interchangeable across changing markets. Conversely, multi-layer composites and sealed, product-locked assemblies often promise short-term performance at the expense of future serviceability. See 2.03 for reversible fixings and no-bond zones (Alexander et al., 1977; Feilden, 2003; Cramer & Breitling, 2007; Schittich, 2005; Addis, 2006). A balanced approach recognises that some elements can and should last for long periods. These include stone or masonry foundations and metal roofing. Other layers are intentionally replaceable, such as claddings, linings, and finishes. They should be set out on open, brand-agnostic grids so substitutions remain feasible without collateral damage (Brand, 1995; Schittich, 2005; Sample, 2016). This aligns with emerging circular policy settings (see 2.05)

Design the dwelling so that parts can be dismantled without damage. Specify interfaces that multiple suppliers can meet. Document the assembly process to ensure future work is within scope and addresses potential risks. Substitution then becomes the usual process by which identity and performance are preserved as material cultures evolve. Flexibility, not stasis, ensures the Bicentennial Home remains repairable, recognisable, and culturally meaningful over time (Brand, 1995; Vale & Vale, 1991; Cramer & Breitling, 2007).

02.07. Evolution of Dwellings: Lessons from History

While sections 2.01–2.06 focus on ensuring the longevity of parts, layers, and materials through techniques like repairable detailing, selective modularity, reversible access, adaptive reuse, and similar substitutions, this section shifts attention from components to the plan. It examines how the arrangement of rooms endures and adapts to cultural changes over time. It also considers how people interact with and modify everyday spaces by opening, closing, and resequencing them.

The history of the dwelling is primarily a history of spatial relations: how rooms are connected, separated, sequenced, and repurposed as social life evolves. Across different periods and cultures, three main factors repeatedly reorganise floor plans: privacy policies, domestic customs, and technologies that modify how air, light, water, heat, waste, noise, and smell are managed. Taken together, these factors explain past transitions from single-room houses to complex suites and from corridors to open-plan designs. They also help anticipate how layouts will continue to change (or remain static) in the future (Rapoport, 1969; Hanson, 1999; Lawrence, 1987).

Early settlements like Çatalhöyük organised life in multipurpose rooms centred around hearths. Later sites, such as Skara Brae, show the first stable internal zoning, with work, storage, and sleeping areas differentiated within compact plans (Hodder, 2006; Childe, 1931). By classical antiquity, houses in Pompeii formalised

privacy and status through axial sequences and graded access, with atria, triclinia, and cubicula transforming movement into a social code (Laurence, 1994). Medieval and early modern Europe then layered "front" and "back," public and private, and servant and family, as households diversified functions and expectations of modesty and comfort increased (Johnson, 1993; Grenville, 1997; Girouard, 1978). Industrialisation intensified this specialisation. Plumbing and heating led to bathrooms and sculleries, artificial lighting changed evening activities, and new work–leisure patterns separated parlours from service rooms (Burnett, 1986; Davidoff & Hall, 2002; Forty, 1986). In the twentieth century, suburbanisation promoted a standard family plan while, paradoxically, opening living, dining, and kitchen into a single space as norms around visibility and gendered labour shifted (Jackson, 1985; Schrader, 2005).

Two countervailing logics underpin this story. One pushes toward openness for sociability, surveillance, and flexibility. The other reinstates separations to manage mess, noise, heat, smell, privacy, and ritual. Japanese domestic traditions demonstrate a long practice of reconciling the two with movable partitions and rooms without fixed functions; surfaces and thresholds choreograph uses across the day without heavy construction (Rapoport, 1969; Brown & Cali, 2001; Young & Young, 2019). Interior scholarship similarly reads the home as a field of adjustable boundaries rather than a fixed set of labels, with fittings, furniture, and lightweight elements acting as instruments of change (Attiwill, 2004; Hanson, 1999)

This explains why open plans both spread and stall. It supports a Europeanised pattern of cooking and entertaining. However, many households prefer a separate kitchen to contain high-heat, high-spice, or intensive cooking, to protect soft furnishings, or to uphold hospitality rituals that keep preparation "back-of-house." Culture, not just convenience, determines the line between display and concealment here (Rapoport, 1969). In essence, the same dwelling type can be experienced through very different spatial grammars.

Looking across this long history, it becomes clear that much of the evolution of the dwelling has been driven by the gradual incorporation of the classical elements into the domestic space. Fire, once centralised in the communal hearth, was formalised into the kitchen and later complemented by appliances for cooking and heating. Water moved from wells to internal plumbing, forming bathrooms, laundry rooms, and bathing rooms. Air and light, once managed through openings and chimneys, were regulated by windows and later by mechanical ventilation. Electricity reorganised domestic life around artificial light and powered appliances, while the internet has more recently embedded an invisible yet vital infrastructure (Forty, 1986; Shove, 2003). Each of these changes reorganised household routines, and each was integrated into flexible spatial frameworks rather than fixed structures dedicated to a single technology (Forty, 1986; Shove, 2003). Now that these essentials are commonplace, future changes are more likely to arise from social shifts, such as household composition, privacy expectations, and work patterns, rather than entirely new room types.

What is evolving now are the relationships between spaces: how quickly thresholds can be created and removed, how easily rooms can split or merge, and how effectively plans buffer sound, smell, and sightlines at different times of day for various household setups (Forty, 1986; Shove, 2003; Hanson, 1999). Expect more "soft-separable" living rather than a fully open plan. Pocket and sliding doors fade away until needed; semi-enclosed nooks support work or sleep; dual-kitchen setups emerge, with an everyday open kitchen paired with a hidden work-kitchen or scullery that deals with heat and odours when cooking practices require it. These are not innovations but modern restatements of longstanding public/private and clean/dirty distinctions (Johnson, 1993; Grenville, 1997; Davidoff & Hall, 2002).

Similarly, some things are unlikely to change much further. Bathrooms and kitchens will stay connected through infrastructure because water, drainage, and hygiene are managed there. Their locations might shift, but their role as service points will remain (Lawrence, 1987; Vale & Vale, 2000). Circulation will continue to shape social order, influencing who or what is seen, heard, and smelled, as households still balance being together with privacy. Space-syntax research confirms these relationships can be arranged in many ways, yet the need for graded access remains strong (Hanson, 1999). The key lesson is not to rely on openness or separation as a rule, but to create adjustable thresholds that households can modify without needing to demolish walls.

For the Bicentennial Home framework, the underlying idea is straightforward. First, treat rooms as flexible spaces rather than fixed entities: living areas should be able to switch between open and closed configurations depending on cooking, work, care, and hospitality needs, with joinery and partitions designed for adjustments (Attiwill, 2004; Hanson, 1999). Second, position service nodes so they can support both open and closed layouts. Kitchens might combine show and work zones, laundries could serve as mudrooms, and bathrooms can separate wet and dry areas, as households will have different ways of setting boundaries over time (Vale & Vale, 2000; Lawrence, 1987). Third, make cultural adaptability a key aspect of the design. Plans should accommodate high-intensity cooking and multi-generational living without needing structural reconfiguration, as these cultural factors are the most dependable indicators of future change (Rapoport, 1969; Schrader, 2005).

Domestic evolution can be seen as a long process of adjusting thresholds. Dwellings last when they enable people to redefine the boundaries between front and back, quiet and noisy, clean and messy, and visible and hidden, at the pace of life rather than construction. This reflects the idea of repairability: creating boundaries that are easy to maintain, reversible, and clear, allowing homes to adapt to shifting cultural and household needs without needing to be rebuilt.

02.08. Historic Precedents of Repairable Homes

This section brings together three threads. Sections 2.01 to 2.03 explain why repairability matters as a design principle. Sections 2.04 to 2.06 examine its implications for whole buildings and for policy. Section 2.07 traces the evolution of domestic layouts. Building on this groundwork, Section 2.08 reviews enduring domestic traditions and shows that long-lived homes arise from legible structures and localised practice, aligning with the Bicentennial Home's repair-first approach (Feilden, 2003; Addis, 2007; Rodwell, 2007).

Throughout history and across diverse cultures, the durability of homes has depended less on extensive renovations or build-demolish cycles, and more on routine, ongoing maintenance. Pre-industrial buildings were designed as assemblies that could be worked on, rather than sealed objects meant to be discarded. Joints were meant to come apart, claddings and finishes were intended for renewal, and parts could be remade or replaced as needed. What was shared across traditions was not a single style but a craft ecology where methods were understandable, repairs were selective, and knowledge was circulated locally and intergenerationally (Feilden, 2003; Addis, 2007; Cramer & Breitling, 2007; Oliver, 2006). This indicates that repeated small acts of care preserved homes, which explains why seemingly modest homes to manors have stayed functional despite evolving tastes and technologies (Feilden, 2003; Cramer & Breitling, 2007; Rodwell, 2007; Addis, 2007).

In the Netherlands, Amsterdam's canal houses, largely from the Third and Fourth City Expansions (1613 and 1662), have remained in residential and mixed use for roughly 300 to 400 years because their foundations and fabric are treated as maintainable systems, not fixed objects (UNESCO, 2010 to 2025). Brick shells sit on timber piles driven into saturated sands. When groundwater or loading conditions change, buildings are relevelled, underpinned, or replied while the shell stays in use. City-scale water management keeps pile heads submerged and biologically stable (Klaassen & Creemers, 2012; Pagella et al., 2024). Inside, framing and floor–stair assemblies follow repeatable standards that shifted from oak to softwood in the seventeenth century. Lime-based mortars localise decay and make routine repointing, reglazing, patching, and targeted replacement feasible (van Tussenbroek, 2023; Groot et al., 2022).

In the United Kingdom, the Georgian terraces of London and Bath, built from about 1715 to 1840, operate as metropolitan testbeds for repairable detailing and planned maintenance (Historic England, 2020). Brick or Bath-stone shells laid in compatible lime mortars confine failure and allow targeted repointing (Historic England, 2017b). Slate and lead roofs can be lifted and re-laid course by course. Timber sash windows, made from repeatable sections, are overhauled by reglazing, re-cording, and spliced repairs. Guidance prefers repair over full replacement (Historic England, 2017a). Much of this eighteenth-century housing remains in everyday use. Bath's fabric from the 1720s to the 1790s still forms a lived-in urban housing stock (UNESCO World Heritage Centre, 1987).

In Puglia, the Trulli of Alberobello show how a stable dry-stone skeleton accommodates many cycles of surface renewal without loss of identity. The settlement has medieval origins, with scattered occupation from around 1000 CE and a village from the mid-fourteenth century. It expanded after 1620 and became a royal town in 1797. It remains inhabited and was inscribed on the World Heritage List in 1996. Corbelled limestone roofs are double-skinned, with an inner tholos and an outer cone laid in courses of thin slabs (chianche or chiancarelle) that are typically 5 to 7 cm thick. The walls are double with rubble cores and are periodically whitewashed with a sacrificial, breathable finish. Since the late twentieth century, plans and handbooks have codified these habits of care, including the General Housing Plan approved in 1978, Regional Law 72/1979, a restoration handbook from 1997, and management plans from 2011 and 2025 that reinforce routine maintenance.

In Libya, the Old Town of Ghadamès shows how earthen and lime-finished domestic buildings endure through regular, collective maintenance. The mud-brick fabric, with palm-wood elements, is routinely replastered and whitewashed with sacrificial, breathable layers that are renewed rather than sealed. This keeps faults local, and repairs proportionate (UNESCO World Heritage Centre, 2025). Field studies record periodic replastering, joint repairs, and relaying of small areas with compatible mixes, all grounded in shared craft knowledge (Abufayed, 2005; Abidi, Alcorn, & Bello, 2010). Recent site management research codifies inspection, small-scale repair, and material compatibility (Alkhalaf et al., 2024).

In Yemen, the mud-brick tower houses of Shibam showcase cyclical renewal on an urban scale. Annual whitewashing, periodic re-plastering, and occasional rebuilding after floods are not signs of failure but expected processes within a clear construction logic (Leiermann, 2021; Cauderay, Wain, & Alsobari, 2022). Earthen walls accept new coats; timber floors are spliced and scarfed; parapets and rain-shedding details are remade as they weather, all documented in technical surveys of Shibam's fabric (Lewcock, 1986; Damluji, 1992). Longevity relies on this rhythm of modest, repeatable tasks, which keeps damage local and protects the overall structure over the centuries. Viewed in relation to today's procurement models, Shibam demonstrates that durability is a sustained pattern of care as much as a property of material (Leiermann, 2021; Lewcock, 1986).

In China, the Beijing siheyuan endures through clear layers and repeatable sections. The type consolidated in the Ming and Qing periods, with much inner-city fabric built from the seventeenth to nineteenth centuries (Wu, 1999; Abramson, 2001). Timber frames, grey-brick walls, and fired-tile roofs are assembled so that faults can be identified and addressed without destruction. Tiles can be re-laid in courses. Purlins and rafters can be repaired with familiar joints. Infill brickwork can be patched where damp or freeze-thaw cycles have caused damage (Zhang, 2015; Wu, 1999). Conservation in Ju'er Hutong from 1989 to 1993 showed that when the construction language is widely understood, work can proceed bay by bay, course by course, and joint by joint, which reduces waste and disruption (Wu, 1999; Abramson, 2001).

In the United States, the Fairbanks House in Dedham, Massachusetts, offers a single-building study in serviceability. Built in the late 1630s to the early 1640s and occupied by the Fairbanks family into the early twentieth century, its pegged timber frame and repairable exterior have supported more than four centuries of use (Cummings, 2002; HABS, 1940). The frame has taken scarf and dutchman repairs without compromising the whole. Clapboards have been re-shingled and repainted. Double-hung sashes have been maintained by reglazing and re-cording rather than being replaced. Over the last century, measured drawings, photographs, and technical documentation reinforce this pattern by keeping sizes, joints, and sequences visible and intelligible (HABS, 1940; Parno, 2013; Cummings, 2002).

In Japan, vernacular Minka and temple carpentry make the principles of repair explicit. Mortise-and-tenon frameworks are built with tolerances for disassembly and reassembly. Infill and finishes are renewed more often than the main structure. In thatched traditions, roofing is replaced on predictable 20 to 30-year cycles through collective effort. Knowledge passes on in practice as much as in writing. The framework survives many replacements because joints and sequences are designed to be read and reversed. Continuity lies in the pattern rather than in any single piece of timber (Rapoport, 1969; Locher, 2010; Young & Young, 2019).

Aotearoa New Zealand follows these patterns and grounds them culturally. Māori whare, built from timber, lashings, raupō, and other biodegradable materials, embody renewal through seasonal and intergenerational practice. Durability rests on kaitiakitanga and knowledge continuity rather than on claims of material permanence (Brown, 2009; Walker, 2004; Royal, 2012). In the colonial era, scarcity and distance fostered a pragmatic repair culture later mythologised as "Number 8 wire". Light timber frames, weatherboards, and corrugated iron were chosen for workability and replaceability. Families patched and extended as means allowed. Many nineteenth-century villas and cottages remain occupied because their construction allows straightforward repairs without specialist equipment or proprietary parts (Schrader, 2005; Wevers, 2006).

The leaky homes crisis shows what happens when that reciprocity breaks down. Sealed composites, hidden fixings, and proprietary systems made assemblies opaque and dependent on single suppliers. Local faults escalated into systemic failures. Integrated claddings and inaccessible junctions turned what should have been simple interventions into large-scale demolition and rebuilds (Hunn et al., 2002; Department of Building and Housing, 2011; Dyer, 2019; Zuccollo & Hensen, 2012; Easton, 2010).

Across human history and across Amsterdam, London and Bath, Alberobello, Ghadamès, Shibam, Beijing, New England, and Aotearoa, the message is practical. Ensure construction is easy to read so faults can be found and fixed without causing collateral damage. Use fixings and junctions that can be undone and redone. Keep components within open and widely used standards. Sustain practice through documentation and intergenerational skills that travel with the house. European incrementalism, Japanese dismantlability, and Māori cyclical renewal show that endurance is cultural as well as material. A dwelling can survive many

replacements when its underlying logic remains stable (Feilden, 2003; Addis, 2007; Oliver, 2006; Rodwell, 2007; Rapoport, 1969; Young & Young, 2019; Brown, 2009; Walker, 2004; Schrader, 2005). Historic homes are not exceptions to sustainability goals. They serve as evidence of a repair-first domestic architecture in which the mundane rituals of care maintain our homes.

02.09. Wealth Bias in Historic Homes and The Democratisation of Durability

This section examines a selection bias in architectural history and examples used in previous sections. Here, we will distinguish between endurance funded by wealth and endurance achieved through design.

Architectural history often favours surviving structures. The buildings we focus on tend to be those linked to wealth and power. Palaces, manor houses, and institutions last not only because they were well constructed but also because they received centuries of maintenance, legal protection, and cultural respect. While the world is filled with examples, everyday homes like cottages, terraces, worker housing, and vernacular structures are rarely studied or documented, and they often vanished from our cities during successive redevelopments after the industrial revolution and onwards. This bias risks equating durability with privilege: many buildings seem "timeless" because they received ongoing support, not because they were better designed (Lowenthal, 2015; Smith, 2006; Pendlebury, 2013). For the Bicentennial Home framework, the main task is to distinguish endurance driven by privilege from endurance achieved through good design.

It is also essential to recognise that many precedents in Section 2.08 were not luxury homes. Amsterdam canal houses combined residential and commercial spaces. Georgian terraces in London and Bath accommodated middle-income populations. The Trulli of Alberobello, Ghadamès and Shibam courtyard houses, Beijing's siheyuan, the Fairbanks House in Massachusetts, and Māori whare are examples of vernacular or mixed-status dwellings. Their longevity depends on clear structures, repairable details, and active maintenance, rather than opulent budgets. These cases demonstrate that durable housing can become mainstream when construction is straightforward and locally manageable.

Conservation scholarship reinforces the distinction. Feilden (2003) shows that iconic buildings often survive through continuous re-roofing and repointing funded by patrons rather than by material superiority. Brand (1995) argues that buildings endure because they are adaptable, maintainable, and valued. Wealth supports adaptability and respect by ensuring access to skilled labour and ongoing care. In short, what endures is often what people with resources choose to maintain.

Recognising this bias strengthens the argument. The Bicentennial Home framework doesn't imitate aristocratic permanence; it aims to democratise endurance. Qualities seen in impressive historic buildings,

such as repairability, adaptability, legibility, and a tradition of care, aren't exclusive to them and can be achieved through design, documentation, and culture. Modern societies are better equipped materially and technologically than those that created much of the heritage stock. Plumbing, reliable power, precision tools, and widespread education are now standard. The wealth needed for durability has decreased, and what once required patronage can now be realised through open standards, accessible detailing, and participatory maintenance (Piketty, 2014; Vale & Vale, 1991, 2009).

Research on economic and material efficiency also questions the idea that durability is elitist. Extending component lifespans minimises both material use and costs (Allwood et al., 2011). Kendall and Teicher (2000) and Durmišević (2018a, 2018b) demonstrate how reversible joints, open interfaces, and accessible service zones allow for incremental, affordable maintenance. Addis (2007) situates these strategies within a long history of repairable practices. Although durable homes might cost more initially, they save money through avoided demolition and simpler renewal cycles, providing environmental and financial benefits over time (Brand, 1995; Chapman, 2015).

Secure, long-term ownership promotes maintenance, while speculative or short-term rental markets often discourage it (Saunders, 1990; Galster, 1987). Murphy (2014) demonstrates how the financialisaton of housing in New Zealand and elsewhere has prioritised capital gain over custodianship, undermining a culture of repair. Collective models such as co-operatives, community land trusts, and long-term leases can share responsibility and foster care among households (Gurran & Bramley, 2017). These approaches reflect earlier traditions of community upkeep, from Māori papakāinga to European guild maintenance, illustrating that durability is as social as it is technical.

Continuity of care is the key factor. Historically, wealth secured that continuity. Today, design and policy can achieve similar results without financial privilege. Four design-led equalisers make this possible. First, transparent layers and accessible system's separate structure, services, and fit-out, allowing ordinary occupants and local trades to carry out repairs (Brand, 1995; Kendall & Teicher, 2000). Second, open standards and performance-based specifications prevent single-supplier lock-in and maintain compatibility as industries evolve (Allwood et al., 2011; Durmišević, 2018a, 2018b). Third, transparent documentation and material passports safeguard vital knowledge about components and assemblies, supporting future maintenance without closed technical data (European Commission, 2020; Webster, 2015). Fourth, visible fixings, reversible joints, and simple detailing suit Aotearoa's DIY culture, making maintenance an act of everyday stewardship rather than a professional monopoly (Schrader, 2005; Till & Schneider, 2005). Collectively, these strategies make durability accessible and participatory, based on clarity, openness, and culture rather than privilege.

When applied widely, these principles recast a two-century lifespan as a civic benchmark rather than an elite one: durability comes from clear service access, reversible junctions, simple materials, and a shared culture of care (tech enablers in 2.03; tenure incentives in 2.12). Longevity isn't a luxury; it's the result of thoughtful, open design and shared stewardship.

02.10. Repairability Integration with Te Ao Māori

This section situates how the concept of long-term repairability demonstrated in previous sections fits within Te Ao Māori, illustrating how kaitiakitanga, whakapapa, mauri, and manaakitanga transform a technical repair approach into an ethical, cultural, and ecological practice.

The concept of repairable, long-lasting housing naturally aligns with Te Ao Māori, which sees the built environment as interconnected with genealogy, ecology, and stewardship. While Western traditions often view buildings as separate objects, Te Ao Māori considers them living parts of people and place, carrying mauri and connected through networks of reciprocal relationships. This worldview broadens repair into a way of caring for and maintaining both the environment and community (Marsden, 2003; Barlow, 1991; Royal 2012).

Kaitiakitanga provides the ethical foundation for a repairable home. It is a duty to protect and preserve both tangible and intangible heritage for future generations, signalling stewardship rather than ownership: the kaitiaki acts on behalf of tīpuna and mokopuna, ensuring continuity of whakapapa through care (Royal, 2012; Barlow, 1991). In architectural terms, the building is not a fixed asset but a taonga that requires ongoing attention and renewal. Traditional Māori buildings embodied this through material and ritual practices: whare were designed and built communally, with locally sourced materials handled with respect and replaced as they aged. This cyclical renewal aligns with contemporary design logics such as disassembly and adaptive reuse; deterioration was anticipated, and care was ongoing. The result is durability through stewardship rather than a false sense of permanence. Applied today, kaitiakitanga shifts focus from consumption to custodianship. A Bicentennial Home becomes a living taonga sustained by successive kaitiaki; designers and occupants share responsibility for the home's mauri through routine repair, thoughtful adaptation, and careful resource use, extending sustainability beyond technical efficiency into ethical and spiritual continuity (adaptive layouts: 2.07) (Henare, 2001; Brown, 2009).

Whakapapa structures relationships between people, whenua, and the built environment. Each act of building adds a layer to a continuous lineage, linking present and future generations to place. For a Bicentennial Home, this implies designing intentionally for intergenerational adaptability: the home is a vessel for stories and connections, not merely a shelter. Māori architecture makes whakapapa visible, with carved figures referencing ancestors, while structural elements such as the poutokomanawa and heke signify

genealogical descent, ensuring that each repair or addition continues the line. Change is not a loss of authenticity when undertaken with respect (Brown, 2009; Barlow, 1991).

Mauri is the life essence present in all entities, including buildings, arising from materials, labour, and the rituals of making. Maintaining mauri requires ongoing care, neglect signals both physical and spiritual imbalance. Repair restores mauri and renews the relationship between people and place (Marsden, 2003; Henare, 2001). This understanding aligns with conservation's emphasis on maintenance as renewal and with long-life/loose-fit approaches to building over time (Feilden, 2003; Brand, 1995). Rather than freezing a house in time, a repairable dwelling remains alive through continual interaction; visible materials, accessible fixings, and legible structure enable occupants to engage directly with the fabric, reaffirming mauri through everyday practice of care (visible, legible detailing: 2.03.)

Manaakitanga extends responsibility beyond the individual dwelling to the community. Marae are maintained, upgraded, and expanded collectively as social needs evolve, demonstrating an architecture of generosity and adaptability. Shared upkeep transforms maintenance from a burden into a practice of unity; contemporary housing can echo this through shared workshops, tool libraries, and neighbourhood repair hubs that revive collective care as a norm (shared tools/repair hubs: 2.12) (Brown, 2009; Barlow, 1991).

Embedding Te Ao Māori within the Bicentennial Home framework redefines durability as a cultural, ethical, and ecological commitment. Kaitiakitanga offers the moral foundation for custodianship; whakapapa provides ongoing temporal and genealogical continuity; mauri ensures materials and structures are treated as living; and manaakitanga places repair within collective well-being. These principles align with the technical strategies introduced earlier. The Bicentennial Home follows this pattern, aiming to be a kāinga tōnui, a resilient, vibrant home that reinforces whakapapa and enacts kaitiakitanga across generations.

02.11. The DIY Culture of Aotearoa: Custodianship and Self-reliance

This section links the repair theory and methods set out in Sections 2.01–2.06 to Aotearoa New Zealand's DIY traditions, showing how they underpin a repair-first housing culture and translating that ethos into design requirements for the Bicentennial Home.

Aotearoa New Zealand has a long tradition of building and repair by ordinary people. Kiwis whose families go back five or more generations often recall the near-mythical grandfather or great-grandfather who built the family home with little more than blood, sweat, and tears on land that cost only a few thousand pounds. Often summed up as the "Number 8 wire" ethos, it reflects a willingness to improvise, adapt, and keep things going with limited resources. This culture grew from rural isolation and material scarcity and now shapes how many New Zealanders think about their homes and their role in caring for them (Derby, 2025;

Wevers, 2006). For a repairable, long-lived dwelling, the lesson is simple: design must let everyday occupants maintain and adapt their homes without needing specialist help at every turn.

As shown in the previous section, Māori communities built and maintained whare collectively using timber, flax, and raupō. Regular upkeep was expected, and renewal was part of a building's life rather than a sign of failure (Walker, 2004). Settlers coming to New Zealand expected to build and maintain their homes. However, households faced distance and supply limits, so they patched, substituted, and modified with whatever was at hand. The "Number 8 wire" shorthand captures this practical inventiveness that carried from farms to houses (Derby, 2025; Wevers, 2006). State housing strengthened these habits: government homes were solid but relied on routine owner maintenance, and guidance encouraged residents to paint, repair, and garden as part of everyday stewardship (Schrader, 2005). In the post-war period, DIY became common sense and later a leisure activity, supported by hardware stores, magazines, and television. Renovation as part domestic life as a regular practice, not an exception (Morrison, 2012).

DIY signals more than just cost savings; many New Zealanders see hands-on work as proof of competence and care, which deepens attachment to place and home. Doing the work builds custodianship because people learn how their dwelling functions and feel responsible for its condition. Research also shows how DIY has been gendered in the past and how participation is broadening as roles change and more people gain practical skills and confidence (Cox, 2016; Morrison, 2012; Wevers, 2006). High rates of owner-occupation have long supported a culture of self-maintenance, though tenure patterns are changing (Stats NZ, 2020; Schrader, 2005). Labour costs and material prices also push households toward do-it-yourself approaches when practical. Retail and media ecosystems amplify this by presenting home repair as achievable and worthwhile (Morrison, 2012). DIY in Aotearoa works like a cultural version of the Right to Repair: it assumes people should be able to service and modify their homes, with components that come apart, parts that can be sourced or substituted, and information that is easy to find and use. When products are sealed or brand-locked, returns and waste increase (iFixit, 2010; Goldheart, 2017; Allwood et al., 2011).

While modern homes include more complex systems, many problems now arise from tightly integrated, sealed assemblies that prevent even minor repairs. Small issues then become significant and costly. The crisis of leaky homes shows how complex, proprietary assemblies can turn local faults into systemic failures that are difficult to fix. In contrast, the rough-sawn weatherboards of old state homes often needed only a quick repair and a coat of paint. The experience in New Zealand points to the cost and disruption that follow when buildings are not designed for accessible inspection and selective repair (Hunn et al., 2002; Department of Building and Housing, 2011; Easton, 2010; PricewaterhouseCoopers, 2009; James et al., 2017; Mosley, 2025).

Designing for DIY culture means applying the lessons learned in earlier sections to make the building legible and workable: provide accessible service zones, use reversible fixings rather than permanent bonds, specify open, brand-agnostic interfaces, and document and label what is built. These steps keep repairs small, lower barriers to participation, and strengthen Aotearoa's DIY culture of care (Kendall & Teicher, 2000; Till & Schneider, 2005; Allwood et al., 2011). In Aotearoa, DIY has shifted from necessity to identity, rooted in Māori collective care and settler improvisation, normalised by state housing, and alive in everyday practice. Treating residents as kaitiaki fits this culture and strengthens the case for repairable design. Design moves that enable DIY (2.03); policy supports (2.05).

02.12. Home Ownership, Stewardship and the Economics of Repair

Building on Sections 2.01–2.06, which cover technical foundations, and Sections 2.10–2.11, which discuss cultural context in Aotearoa New Zealand, this section shows how tenure and ownership conditions enable or suppress repairs in practice.

The repairability of housing depends not only on design and construction but also on ownership patterns. Homes owned and occupied long-term are more likely to be repaired, maintained, and adapted. Conversely, houses that circulate through speculative markets or are held mainly as investment assets often receive little care. Ownership is thus a key factor in custodianship: repairability can reach its full potential only when occupants are motivated to act as stewards rather than short-term users. For the Bicentennial Home framework, which is based on intergenerational care, ownership structures are as important as material choices (Saunders, 1990; Galster, 1987). In ecological terms, stewardship brings forward small, timely interventions that reduce material throughput, preserve embodied carbon, and avoid high-emission replacements.

High homeownership rates have traditionally supported New Zealand's housing system. Earlier in the mid-twentieth century, government lending, mortgage assistance, and the state-housing programme of the 1930s–1940s laid the groundwork for widespread ownership and a culture of routine upkeep (Thorns, 2000; Schrader, 2005). Ownership also carried expectations of responsible care: homes, particularly state houses, were designed for durability, and families were encouraged to perform routine maintenance through manuals and advice campaigns, aligning social policy with architectural longevity (Schrader, 2005). By the 1990s, homeownership peaked at about 74 per cent, then fell to around 64–65 per cent by 2018, the lowest level in almost 70 years, as Stats NZ reported when releasing Housing in Aotearoa: 2020 (Stats NZ, 2020; Goodyear, 2020).

From the 1990s, homeownership declined as economic restructuring, reduced state support, and speculative dynamics made ownership less attainable for younger households (Murphy, 2014). By 2018, the national

homeownership rate was about 64 percent, with lower rates in major cities (Stats NZ, 2020; Saville-Smith, 2019a). As the rental sector expanded, short tenancies and minimal maintenance became common, shifting the system away from custodianship toward commodification.

Private renting often creates barriers to repair and maintenance, with responsibilities split between tenants and landlords. This division can lead to gaps where neither party is motivated to act. Tenants seldom invest in repairs due to limited authority and short-term perspectives, while landlords might delay maintenance to reduce costs, especially when focused on short-term profits or capital gains (Galster, 1987; Crook & Kemp, 2011). Evidence from around the world indicates rental properties tend to deteriorate more than owner-occupied homes under these circumstances (Galster, 1987). In New Zealand, shorter average tenancies exacerbate this problem: tenants usually do not stay long enough to see the benefits of repairs, and some landlords treat homes mainly as resale assets (Saville-Smith, 2019a; Crook & Kemp, 2011). Even when issues are addressed, replacement is often preferred over repair since labour is high and landlords must pay contractors, fostering a disposability mentality. Ecologically, this bias increases embodied emissions and construction waste, whereas timely maintenance could have prevented the issue and reduced the overall environmental impact of carbon.

This misalignment shows that repairability is not just a design issue; it also relies on who has the authority and motivation to repair. Without clear ownership or shared responsibility, minor faults go unnoticed and develop into bigger problems, leading to more waste and higher embodied carbon. Who pays the energy bill strongly influences upgrade decisions; aligning capital costs with bill savings reduces under-investment in efficiency. Mandates and subsidies that address this split incentive are summarised in 2.05. In rental housing, this alignment often breaks down due to a split incentive: landlords face the upfront costs while tenants benefit from the savings, leading to systematic under-investment in cost-effective efficiency measures. International evidence highlights the extent of this principal–agent problem; the IEA estimated over 3,800 PJ per year of energy use is affected across case studies, and US analyses show underinvestment in efficient end uses where ownership and bill payment are separated. (IEA, 2007). In Aotearoa, the Healthy Homes Standards mandate insulation and fixed heating in rental properties, and Warmer Kiwi Homes subsidises upgrades for owner-occupiers. Both measures help reduce the split incentive and turn bill-paying motivations into actual improvements to building fabric and systems, thereby cutting emissions and enhancing indoor environmental quality over time (New Zealand, 2019; Tenancy Services, 2025; EECA, 2025).

Stable ownership fosters a sense of custodianship, as households expecting long-term residence are more inclined to invest in maintenance and repairs to protect their equity and pass down a legacy. This perspective views housing as a responsibility across generations, not merely an asset (Saunders, 1990). Environmentally, long-run custodianship supports circular behaviours such as reclaiming components, salvaging timber, and

incremental fabric upgrades that cut both embodied and operational emissions. In contrast, financialised housing markets can erode this custodial sentiment by emphasising capital gains over proper upkeep, often resulting in deferred maintenance and undervaluing repairability (Murphy, 2014; Aalbers, 2017). The ecological cost is premature obsolescence and more intrusive retrofits or demolition, each carrying significant carbon penalties and resource extraction.

Ownership combined with design for renovation offers people freedom in their homes. Flexible partitions, clear service nodes, and open, brand-agnostic interfaces allow households to adjust layouts as routines and tastes evolve, from simple aesthetic updates to significant life-stage changes. Homes can support ageing in place and can welcome whānau by transforming a garage into a minor dwelling or adding a small granny flat (Brand, 1994; Kendall & Teicher, 2000; Till & Schneider, 2005).

For a 200-year dwelling, repairability must be supported by ownership models that embed responsibility and continuity. Design can lower barriers so both tenants and landlords can act; policy and tenure frameworks can do the same. Community land trusts, co-ops, and co-housing distribute responsibility and align incentives for long-term care (Gurran & Bramley, 2017). These models can also encode green covenants and stewardship plans that specify maintenance and retrofit schedules aligned with carbon budgets and circular economy principles targets.

The Bicentennial Home needs both technical and social innovation. Aligning ownership structures with repairable design supports physical durability, cultural continuity, and economic resilience. It also shrinks waste streams, preserves embodied carbon, and keeps materials circulating at their highest value across multiple lifecycles. Without committed custodians, even the most repairable systems risk neglect. In short, New Zealand's historically high homeownership fostered custodianship; its decline, alongside the rise of private renting, has weakened those traditions. To achieve a two-century service life, repairability must be underpinned by tenure models that uphold responsibility and continuity (Saunders, 1990; Galster, 1987; Stats NZ, 2020; Saville-Smith, 2019a; Crook & Kemp, 2011; Murphy, 2014; Aalbers, 2017; Gurran & Bramley, 2017).

02.13. Determining what a Trend is in Architecture

This section distinguishes transient fashions from enduring principles so the Bicentennial Home framework can remain relevant as tastes and technologies change. (see 2.02; 2.03; 2.06)

In architecture, a trend is a temporary change in design, layout, materials, or methods that spreads through professional circles, media, and markets. These changes are often driven by broader socio-economic factors, such as the financialisation of housing, which prioritises saleability and branding over functionality and stewardship (Aalbers, 2017). (see 2.12) In contrast, enduring principles address constant human and

environmental needs like light, shelter, privacy, thermal comfort, adaptability, and maintenance access. These needs remain consistent over time, even as their specific expressions differ across cultures and historical periods (Rapoport, 1969; Brand 1995). (see 2.07 for spatial patterns; 2.03 for maintenance access)

Trends typically pass through well-known phases: innovation, early adoption, mainstreaming, saturation, and decline. However, the slow pace of the built environment can obscure how brief these phases are. Signs of a trend's short lifespan include reliance on a single product or seal, dependence on hidden or irreversible assemblies, and a limited stylistic vocabulary that can't accommodate alternative uses. For example, the default open-plan design that can't be enclosed for acoustic, olfactory, or thermal reasons, the all-white integrated kitchen with surfaces that stain and quickly date, or the large unshaded window wall that increases cooling demands, these are not failures by themselves but can become liabilities if the building fabric can't adapt without significant demolition or invasive modifications. (see 2.03; 2.06) Ultimately, what lasts is a dwelling's ability to adapt quickly at superficial levels while maintaining the integrity of its deeper layers. (see 2.02)

A practical test for longevity naturally derives from the layered view of buildings. (see 2.02) First, determine if a feature provides a persistent function rather than just reflecting taste. When energy prices rise, codes tighten, or household routines change, does it continue to work? (see 2.05) Second, assess cultural flexibility, whether different households, cooking traditions, or care setups can adapt the feature without rebuilding. (see 2.07) Third, verify layer compatibility in Brand's sense: can the feature be renewed at its own layer without impacting slower layers like the structure or primary envelope (Brand, 1995). (see 2.02) Fourth, evaluate repairability, look for reversible fixings, replaceable parts, and clear documentation that enable targeted repairs instead of replacing entire assemblies (Kendall & Teicher, 2000; Till & Schneider, 2005). (see 2.03) Fifth, check supply resilience, are the dimensions and performance consistent so that compatible parts remain available as brands evolve? (see 2.06) Sixth, consider environmental fit, does the feature minimise material throughput over time through selective repair and upgrading, making it the greener choice for both carbon footprint and cost (Allwood et al., 2011; Chapman, 2015). (see 2.05) Features meeting these criteria tend to appear' timeless" because they allow for multiple future interpretations rather than insisting on a fixed approach. (see 2.14)

Recognising fads before they become outdated involves observing how assemblies disassemble over time. Claims of' maintenance-free" performance often hide units that are glued, laminated, or sealed, making local repairs impossible. (see 2.03) Products with closed profiles or proprietary gaskets tie the dwelling to a specific supplier's business model rather than sound building principles. (see 2.06 and 2.08) Spatial gestures that erase necessary boundaries for work, care, cooking, or resting can also be trends when they eliminate the creation of thresholds at different times of the day. (see 2.07) When such choices are embedded in slow-

changing layers, obsolescence speeds up and refurbishment becomes more challenging and wasteful. (see 2.02; 2.04)

Designing for timelessness is about fostering the ability to reinterpret, not creating a static look. Plans should be flexible, able to open for social interaction and close to retain heat, smell, noise, or privacy, using sliding or pocket partitions, acoustic corners, and dual kitchens that position a standard show kitchen next to a work scullery where needed. (see 2.07) This approach reflects a long tradition of adaptable domestic boundaries and suits modern requirements for hybrid work, caregiving, and hospitality (Rapoport, 1969; Hanson, 1999). Interfaces should be open and neutral, with kitchens, wardrobes, and service points arranged on clear grids with accessible fixings, so taps, benchtops, and hardware can be replaced or upgraded without damaging other layers (Kendall & Teicher, 2000). (see 2.03; 2.06)

Applied to familiar examples, the distinction becomes clear. A fully open plan that falls short on acoustics and odours often leads to makeshift partitions. A better baseline plan offers closable thresholds and positions service points to support both open and enclosed layouts. (see 2.07) An integrated, monochrome kitchen will become dated; a sturdy carcass on an open grid with replaceable parts ensures longevity. (see 2.03; 2.06; 2.11)

02.14. Towards a Theory of Design for Renovation

The Bicentennial Home advances Design for Renovation (DfR) as a distinct architectural condition. Unlike Design for Disassembly, which focuses on material recoverability at the end of service life, DfR centres on extending service life through ongoing maintenance, incremental repair, and cyclical upgrading within a lived regulatory and tenure context. It does not treat adaptability as a one-time spatial option, nor does it assume eventual disassembly as the primary objective. Repairability is therefore understood not simply as the technical possibility of removal, but as a systemic relationship between construction logic, compliance pathways, economic thresholds, and everyday custodianship in Aotearoa New Zealand. In this formulation, housing longevity arises from symbiosis between occupants and legible, separable building systems rather than from end-of-life recoverability alone.

In this thesis, symbiosis is not a metaphor but a structural condition. It describes a reciprocal dependency in which construction systems are designed to invite intervention and occupants are positioned as active maintainers rather than passive consumers. Longevity depends on sustaining this reciprocal capacity across generations. The central claim advanced here is that housing longevity in Aotearoa depends on preserving homeowner–building symbiosis through construction systems that remain legible, accessible, and non-proprietary within contemporary regulatory conditions.

Throughout the previous sections, repairability has been shown to depend on three interconnected conditions: physical access, cultural participation, and systemic support. These are not supplementary qualities but structural prerequisites for sustaining homeowner–home symbiosis over time (see 2.02–2.03 and 2.06). Cultural participation draws on shared values, skills, and expectations, including Te Ao Māori concepts of kaitiakitanga and Aotearoa's DIY traditions (see 2.10–2.11). Rather than incidental cultural traits, these traditions function as historically embedded mechanisms through which households maintained, modified, and extended their homes without wholesale reconstruction. Systemic support encompasses legal, economic, and governance frameworks that enable small, ongoing acts of care rather than cycles of neglect and demolition (see 2.05 and 2.12). When aligned, these conditions make repairability both feasible and self-reinforcing.

A repairable home functions as an open system, maintaining its identity by remaining understandable, functional, and adaptable across generations. Its slower layers of structure, envelope, and foundations provide continuity, while faster layers such as services and finishes are designed for reversal and change. This hierarchy reflects a broader understanding of architecture as process rather than product. Buildings endure through interaction, maintenance, and renewal rather than static form, echoing Brand's observation that adaptable buildings survive while inflexible ones are replaced (Brand 1995). Where construction systems collapse layers, conceal services, or rely on proprietary interfaces, the symbiotic cycle weakens. Minor repair becomes technically complex, economically prohibitive, or legally constrained, shifting maintenance from routine homeowner care to episodic specialist intervention and increasing the risk of deferred upkeep and compressed lifespan. The erosion of DIY-capable construction logic in Aotearoa is therefore not culturally neutral but architecturally consequential. Compared with earlier timber-framed homes that offered accessible subfloors and separable linings, many contemporary assemblies reduce homeowner intervention capacity through integrated envelopes, slab-embedded services, and proprietary systems, weakening the maintenance cycle that historically sustained domestic longevity.

A related risk lies in the progressive professionalisation of minor repair. As building systems become more integrated, compliance-intensive, and reliant on proprietary components, tasks once managed as routine household maintenance shift to licensed specialists. While regulation remains essential for life-safety systems, extending this logic into everyday repair raises the threshold for intervention and reduces occupant agency. Faults that might previously have been addressed incrementally are deferred until substantial, consented work is required. Over-professionalisation alters the temporal rhythm of care, replacing continuous, low-level care with episodic, high-cost interventions. The architectural consequence is a weakening of homeowner–home symbiosis, with direct implications for long-term service life.

Within this thesis, repairability extends Brand's shearing layers by introducing two additional dimensions: social participation and material openness. Social participation operates as an architectural performance criterion. A home designed for renovation must enable routine maintenance, repair, and component replacement by homeowners and local trades without invasive demolition, specialist tools, or proprietary knowledge (see 2.03 and 2.11). Material openness requires that components remain interchangeable as technologies and supply chains evolve, ensuring that like-for-like substitutions maintain performance and identity over time (see 2.06). Together, these principles frame the building as a durable structural framework capable of accommodating change while conserving embodied energy and cultural continuity.

Repairability also carries ethical and ecological implications. Extending material lifespans and reducing waste aligns with circular economy goals outlined in policy (see 2.05) and supports a low-carbon transition through the conservation of embodied energy. By lowering technical and financial barriers to maintenance, it also advances social equity, making it easier to sustain safe, warm, and adaptable homes. In doing so, repairability strengthens cultural resilience by linking the care of homes with the care of people and place, consistent with kaitiakitanga and long-term stewardship principles (see 2.10).

From this, six propositions can be distilled. First, repairability is historically recurrent, evident across cultures in repair-first domestic traditions and enduring building practices (see 2.01 and 2.08). Second, repairability is relational, emerging at the intersection of design, culture, and governance, such that durable architecture depends as much on people and institutions as on materials and details (see 2.05 and 2.10–2.12). Third, repairability is layered, structuring buildings to protect slower elements while keeping faster systems accessible and adaptable (see 2.02–2.03). Fourth, repairability is open, relying on transparent information, non-proprietary interfaces, and material interchangeability as technologies evolve (see 2.06). Fifth, repairability is cumulative, built through incremental acts of care rather than periodic reconstruction (see 2.01 and 2.11). Sixth, repairability is symbiotic: longevity depends on sustained interaction between legible construction systems and empowered occupants (see 2.11–2.12). Where buildings invite routine intervention, care accumulates; where intervention is structurally discouraged, maintenance is deferred and lifespan contracts.

To bridge theory and practice, the Bicentennial Home functions as a speculative lens rather than a fixed model. It invites designers to consider what would change if housing were conceived not for immediate completion but for sustained renewal across generations. Rather than prescribing a uniform solution, it foregrounds a series of architectural considerations through which repairability can be meaningfully examined.

It draws attention to stewardship as a design value, encouraging the transmission of knowledge, traditions, and care (see 2.08 and 2.10–2.11). It asks how layered accessibility might be made visible and intelligible

through maintenance routes and reversible detailing (see 2.03). It foregrounds the role of material continuity through open interfaces and documented substitution logic, allowing components to be replaced without systemic disruption (see 2.06). It highlights the importance of transparent documentation, including building logbooks and accessible records, so that future occupants are not required to rediscover how their home functions (see 2.03 and 2.05). It also raises the question of how governance and tenure structures might better support long-term maintenance rather than rely solely on goodwill (see 2.12).

The two-century horizon is not intended as a literal guarantee of performance. It is selected precisely because it exceeds the span of an individual lifetime. By situating design decisions beyond personal occupancy, the timeframe shifts attention from short-term ownership cycles toward intergenerational custodianship (see 2.10–2.12). It functions as a temporal lens through which questions of maintenance, legibility, and repair capacity become unavoidable. It operates as a disciplinary provocation, encouraging the profession to test whether contemporary housing supports meaningful interaction between legible construction systems and empowered occupants. In this framing, durability is not permanence but continuity through care. A home that can be understood, maintained, and adapted by its occupants has the potential to endure.

Chapter 03: Methodology

03.01. Research Approach & Design Logic

This thesis adopts a qualitative, research-led approach grounded in architectural theory, historical inquiry, and comparative case study analysis. Architecture is treated as an object of critical investigation rather than a site of experimentation or proposal. Building on the theoretical, cultural, and ethical framing developed earlier in the thesis, particularly through the literature review on repairability, custodianship, and housing longevity, the research seeks to demonstrate that housing durability is not a stylistic or purely material outcome. Instead, it is the result of cultural, technical, and regulatory systems that shape how dwellings are constructed, inhabited, and maintained over time.

This research is structured around the analysis of homes that have undergone successive cycles of repair, modification, and adaptation, as well as housing that has proven resistant to such change. These case studies serve as primary evidence, enabling the thesis to examine how construction logics, material assemblies, and access strategies determine whether maintenance and renovation remain feasible across generations. By focusing on the evolution of dwellings rather than their moment of completion, the research foregrounds time, care, and change as critical architectural conditions.

Analytical drawing, redrawing of precedents, and construction analysis are used to interrogate existing buildings rather than to generate new design proposals. These methods make visible the relationships among assembly, accessibility, and agency that underpin repairability. Drawing is therefore treated as a tool of clarification and critique, allowing the repairability of housing to be evaluated as a spatial and technical condition embedded within its fabric. A structured relationship between theoretical framing and analysis, situated within the cultural, material, and regulatory context of Aotearoa New Zealand. Concepts drawn from right-to-repair discourse, housing longevity research, and Te Ao Māori principles such as kaitiakitanga are developed through the literature review and cultural analysis presented earlier in the thesis. This serves as evaluative criteria against which case studies are selected and interpreted.

This thesis does not seek to provide a universal solution, nor does it claim to be predictive of outcomes. It aims to identify recurring patterns, constraints, and tensions that shape housing durability in Aotearoa New Zealand. These include the distribution of responsibility between occupants and industry, the influence of regulatory and economic frameworks on repair practices, and the relationship between adaptability and residential intensification. These conditions emerge from the historical, material, and typological context of New Zealand housing. The methodology prioritises depth, specificity, and contextual understanding, recognising that housing longevity arises through cumulative, situated decisions rather than isolated technical interventions.

By this approach, centred on observation, comparison, and critical interpretation, this section establishes the basis for the thesis's claims. The contribution of the research lies not in proposing a single architectural model, but in demonstrating, through theoretical grounding and case-study evidence, how repairability and custodianship can be understood, evaluated, and foregrounded as essential criteria for sustainable housing across generations in Aotearoa New Zealand.

03.02. Methodical Framework

The methodological framework for this thesis is structured as a cumulative, comparative process that synthesises and analyses multiple forms of evidence. The research proceeds through a circular logic in which theoretical framing, case study analysis, and material interpretation are repeatedly brought into relation. Through this approach, individual observations are not treated as isolated findings, but as components of a growing body of evidence that supports or challenges an emerging, observable pattern.

Case studies occupy a central position within this framework. They provide concrete instances through which theoretical claims can be examined against built reality. Rather than serving as exemplary models or design precedents, case studies are treated as evidence of how housing performs over time. Their value lies in revealing how construction systems, material choices, and degrees of accessibility shape the capacity for repair, modification, and ongoing maintenance. By examining both housing that has adapted successfully and housing that has resisted change, the framework sharpens contrasts and exposes underlying logics.

Analysis within this framework is comparative rather than sequential. Theoretical criteria established earlier in the thesis remain as reference points throughout. Over time, repeated alignment between theory and observation allows certain patterns to be recognised as systemic rather than incidental.

The framework is intentionally non-prescriptive. It does not aim to reduce findings to a single solution, typology, or technical system. Instead, it is designed to support careful accumulation, cross-checking, and interpretation of evidence, enabling the thesis to make claims about housing longevity that are defensible within the specific context of Aotearoa New Zealand. By highlighting consistency, recurrence, and relational logic, the framework grounds its conclusions in observable conditions, encouraging readers to apply these principles within their own work.

03.03. Precedent Importance

In this research, historical architectural precedents are understood as evidence that repair, modification, and long-term maintenance have long been normal conditions of housing rather than exceptional responses to failure. The precedents discussed earlier in the thesis establish that dwellings have traditionally been conceived as adaptable frameworks, capable of absorbing change through repair and renewal over time.

Their primary value lies not in formal or stylistic reference, but in demonstrating that housing longevity has long depended on continuous intervention rather than cycles of replacement.

The precedents examined through the literature review reveal that repair and renovation were historically expected and culturally embedded practices. Housing that has been repaired, extended, subdivided, or incrementally altered over generations illustrates how buildings were designed to remain legible, accessible, and serviceable. In this context, precedents function as records of accumulated care, in which repeated interventions reflect an accepted relationship between occupants and the built fabric. This contrasts sharply with contemporary construction cultures in which demolition and replacement are often treated as routine or inevitable.

Analysis of these precedents shows underlying construction logics rather than surface characteristics. Directing attention to structural frameworks, material assemblies, junctions, and degrees of accessibility that enabled ongoing repair and adaptation. By examining how components were historically replaced, altered, or upgraded without wholesale loss of fabric, the research identifies principles that supported long-term stewardship. These observations reinforce the thesis argument that repairability is a systemic condition embedded in construction logic rather than a matter of stylistic choice.

Precedents are also read comparatively to demonstrate consistency across time and context. Rather than serving as isolated examples, they collectively establish a historical baseline against which contemporary housing practices can be evaluated. Through this comparison, demolition-led development emerges as a relatively recent departure from long-standing norms of care, maintenance, and incremental renewal, rather than the traditional building practice it is often framed to be.

Importantly, these precedents are not mobilised to advocate a return to historical forms or construction methods. Instead, they are used to challenge assumptions of inevitability surrounding demolition and replacement, and to extract principles that remain relevant under contemporary conditions. By establishing repair as a historically normal condition of housing, precedent analysis strengthens the thesis position that current patterns of disposability reflect cultural, technical, and regulatory shifts rather than inherent limitations of housing itself. In doing so, precedents contribute to the cumulative body of evidence supporting housing longevity and repairability as achievable and culturally grounded practices worldwide and in Aotearoa New Zealand in particular.

03.04. Case study Selection

Case studies are selected to support the thesis's aim of examining housing longevity through observable patterns of renovation, repair, modification, and adaptation over time. Rather than representing exemplary or idealised projects, the selected cases function as evidence of how ordinary housing performs across

successive renovation cycles. The study focuses on four average homes from across Aotearoa New Zealand. Two have been repeatedly renovated and maintained, while two operate as counter cases, in which further repair is unlikely, and demolition is anticipated in the foreseeable future.

Together, these juxtapositional cases enable the research to examine how different construction logics, material assemblies, and access conditions either support continued renovation or lead to thresholds at which repair becomes impractical or uneconomic. The contrast makes visible the architectural and systemic conditions that sustain housing longevity, as well as those that accelerate disposability.

The selection of these homes is guided by several core criteria that apply to both ongoing renovation and its breakdown. Each case exhibits a legible renovation trajectory, either through repeated minor works and accumulated layers of repair, or through a clear point at which renovation becomes constrained, deferred, or abandoned in favour of replacement. This temporal dimension is essential, as the research concerns how dwellings respond to use, failure, and intervention across generations rather than how they perform at completion. The cases enable close examination of construction systems and material assemblies at a level of detail sufficient to assess accessibility, legibility, and repair capacity within renovation processes, including situations in which limited access, material incompatibility, or regulatory constraints render further repair impractical or uneconomic. Together, the cases span a range of housing typologies and construction periods, allowing comparison across differing regulatory, economic, and technical contexts that shape both the continuation of renovation and the conditions under which it breaks down.

Geographic and cultural relevance further inform selection. Primary emphasis is placed on housing in Aotearoa to ensure that renovation outcomes are analysed in relation to local material cultures, regulatory frameworks, and expectations regarding maintenance and upgrade. International precedents are cited only when they clarify shared principles or contrasting outcomes, and are used comparatively rather than as models to be replicated.

Throughout the research, all case studies are analysed using a consistent set of evaluative criteria established earlier in the thesis. This enables comparison across time, typology, and condition, and supports the cumulative methodological logic in which repeated alignment between renovation outcomes and construction principles builds a defensible body of evidence.

By framing case study selection as an evidentiary process centred on renovation and its limits, this section establishes the foundation for the analytical chapters that follow. The selected cases enable the thesis to test claims about repairability, custodianship, and housing longevity through observed renovation trajectories, grounding the research in the realities of housing change rather than in speculative or idealised scenarios.

03.05. Analytical Methods

The analytical methods used in this thesis are qualitative, comparative, and interpretive, and are selected to make renovation processes legible as architectural evidence. Rather than evaluating buildings as finished objects, analysis focuses on how dwellings changed through renovation, repair, and adaptation over time. Renovation events are moments where underlying construction logics can be inferred, particularly at points of access, junctions, and apparent failure.

Case studies are examined through architectural drawing, selective redrawing, and construction analysis based primarily on floor plans, limited elevations, and available documentation. Existing drawings, archival material, and site information are synthesised into analytical drawings that speculate on assembly sequences, material junctions, service routing, and points of access. Redrawing is used not to idealise buildings, but to clarify plausible construction relationships and likely paths of intervention during renovation.

Observed and inferred renovation acts, such as recladding, re-roofing, service replacement, internal reconfiguration, or structural alteration, are used to interpret the extent to which existing fabric been retained, removed, or bypassed. The apparent scale and invasiveness of these interventions are read as indicators of repairability. Where small defects have led to extensive removal or replacement, this is interpreted as evidence of construction systems that resist incremental renovation. Conversely, cases where change appears localised and reversible suggest construction logics that support ongoing adaptation.

Comparative analysis is used to identify recurring tendencies across case studies. This includes comparison across housing typologies, construction periods, and regulatory contexts to understand how renovation outcomes are shaped by material selection, assembly methods, and access strategies. Patterns are not treated as universal rules, but as recurring conditions that gain significance through repetition across multiple cases. This comparative reading supports the cumulative logic of the thesis, in which alignment between observed renovation outcomes and construction principles strengthens interpretive claims.

Interpretation is guided by evaluative criteria developed earlier in the thesis, including accessibility, reversibility, material continuity, and capacity for incremental change. These criteria are applied consistently across all cases to maintain analytical coherence. The aim is not to score or rank buildings, but to develop relational insight into how renovation appears to sustain or undermine housing longevity over time.

Throughout the analysis, attention is paid to the roles of occupants, trades, and regulatory systems, as inferred from renovation outcomes rather than from direct testimony. Renovation is understood as a negotiated process shaped by cost, compliance, skill availability, and cultural expectations of care. Analytical methods remain attentive to both the physical construction and the conditions under which renovation is

likely to occur. Each case study is examined through a brief analytical narrative. These analyses synthesise drawing-based interpretation, material reading, and inferred renovation history to articulate what can be learned from each dwelling's evolution. Attention is given to how each house has adapted, where renovation has been constrained or abandoned, and which architectural conditions appear to have supported or undermined ongoing change. These case analyses develop reasoned interpretations of how and why each dwelling did or did not continue to evolve.

03.06. Data Sources

The research draws on a limited set of qualitative data sources focused on architectural interpretation. Evidence is generated primarily by reading the existing built fabric and by drawing on and analysing drawings and records to infer how dwellings may have evolved over time.

The primary source of evidence consists of the author's analytical drawings. These are produced from available floor plans, limited elevations, site observation where possible, and publicly accessible information. Through drawing and redrawing, the research documents spatial arrangements, construction logic, material junctions, and access conditions. The drawings do not claim to reconstruct verified renovation histories. Instead, they function as interpretive tools that support reasoned speculation about how buildings have been assembled, altered, repaired, or constrained over time. Drawing is therefore central to the generation of evidence, allowing renovation potential and limitation to be read from present conditions.

Interpretation is informed by architectural knowledge developed through the literature review. Historical housing practices, precedent analysis, right-to-repair discourse, and studies of material behaviour provide the conceptual framework for inferring plausible renovation trajectories. These sources guide interpretation.

Secondary sources, including academic literature, technical guidance, and regulatory documentation, are used to contextualise the interpretive drawings rather than to supply direct evidence of change. New Zealand-specific building code requirements, consent pathways, and renovation-related policy frameworks inform understanding of the regulatory conditions under which repair or renovation may have occurred or been discouraged.

The absence of comprehensive renovation records is treated as a condition of the research rather than as a deficiency to be resolved. Gaps and uncertainty reflect broader issues of legibility, access, and knowledge transfer within housing systems, which directly affect the feasibility of repair and future renovation. Claims

about housing longevity and repairability are therefore grounded in observable built conditions and in informed architectural reading, rather than in complete or verified renovation histories.

03.07. Research Limitations

This research is undertaken from the position of an architectural researcher working within the cultural, regulatory, and material context of Aotearoa New Zealand. The thesis approaches housing through a renovation-focused lens that prioritises longevity, custodianship, and incremental change. This position shapes the selection of case studies, the choice of analytical tools, and the interpretation of renovation outcomes; this bias is acknowledged as an integral part of the research rather than a condition to be neutralised.

The methodological emphasis on architectural drawing and construction analysis privileges legibility, accessibility, and material logic as primary modes of understanding housing change. This enables close reading of renovation potential and constraint, but necessarily foregrounds spatial and technical conditions over social, financial, or experiential dimensions that are less visible in the built fabric. While these broader dimensions are addressed in the existing literature and policy discourse, they are not empirically investigated in this study.

The research is qualitative and case-study based, which limits its capacity for statistical generalisation. Case studies are selected for their ability to reveal renovation trajectories and thresholds rather than for representativeness across the housing stock. Findings are therefore advanced as interpretive insights grounded in consistency and recurrence, not as universal claims.

Access to comprehensive renovation histories is uneven. Formal records often capture only consented work, whereas informal repairs and unrecorded modifications remain largely invisible. Rather than treating this absence as a methodological flaw, the research understands it as symptomatic of broader issues of legibility, access, and knowledge transfer within housing systems. These absences directly affect the feasibility of the renovation and are therefore analytically significant.

The research prioritises observable renovation outcomes over direct occupant testimony. This limits engagement with subjective experience, household narratives, and emotional attachment, but allows analysis to remain focused on material consequence and architectural condition. Questions of lived experience and meaning are addressed indirectly through scholarship on custodianship and care rather than through primary empirical research.

Finally, the thesis concentrates on the architectural scale of the dwelling. Broader urban, economic, and planning systems are considered only insofar as they intersect with renovation decisions at the level of the

house. This boundary is intentional and allows sustained attention to the architectural conditions that enable or constrain long-term renovation. The research does not seek to prescribe solutions or exhaustively account for all dimensions of housing longevity. Instead, it offers a situated, architectural reading of how renovation practices reveal the conditions that support or undermine long-lived housing in Aotearoa New Zealand.

03.07.1. Additional methodological Transparency

This thesis was written and revised by the author. Digital writing-assistance tools, including Grammarly and Apple's on-device AI writing tools, were used to support proofreading, clarity, grammar, and sentence structure. These tools functioned solely as editorial aids and did not contribute to the development of arguments, analysis, case selection, drawings, or theoretical positions. All interpretations and conclusions presented in this thesis are the author's original work.

03.08. Resulting Methodology

Taken together, the preceding sections establish a methodology based on cumulative interpretation rather than linear testing or iterative development. The research framework operates through the assembly, cross-reading, and interpretation of architectural observations informed by precedent, theory, and material logic. Claims about housing longevity emerge through repetition and alignment across case studies, rather than through hypothesis testing or the optimisation of a singular outcome.

Within this methodology, renovation operates as the primary analytical lens. Case studies are examined at moments of apparent change, constraint, and intervention, where construction systems become legible through access, alteration, or failure. Analytical drawing and redrawing are used consistently across all cases to support comparability, allowing spatial arrangements, construction logic, and access conditions to be read in relation to one another. Each case is interpreted against the same evaluative concerns, including accessibility, reversibility, material continuity, and capacity for incremental renovation, clarifying how construction decisions shape the potential for ongoing change.

The case studies that follow are not illustrative examples appended to a completed argument. They are the principal means through which the argument is developed. Each analytical narrative contributes to the thesis's cumulative reasoning by examining how individual dwellings have adapted, where renovation has been constrained or foreclosed, and which architectural conditions appear to have supported or undermined continued care over time.

Rather than progressing toward a prescriptive model or definitive conclusion, the methodology builds understanding through comparison and recurrence. Where similar renovation pressures produce similar

outcomes across different housing types and periods, those outcomes gain explanatory weight. Where divergence occurs, it is treated as instructive, revealing the limits and tensions embedded within particular construction logics or regulatory contexts.

By the conclusion of the case study chapters, this methodology enables the thesis to move from individual, situated readings of housing change toward a defensible architectural account of the conditions that support or undermine long-term housing durability in Aotearoa New Zealand. The transition from methodology to case study analysis is therefore not a shift in mode, but a continuation of the same interpretive logic at a finer level of detail.

Chapter 04: Materials for Longevity and Repairability

04.00. Introduction

The materials selected for a building often determine its longevity. They influence how well it withstands the weather, how frequently it requires maintenance, and whether everyday occupants can keep it maintained through repairs. It is hard to argue that materials are ever truly neutral. Some come with long-lasting maintenance requirements and high resilience, while others tend to fail quickly and are difficult to reuse. A house meant to last for centuries is unlikely to succeed if it relies on materials that cannot be repaired or reused once they have deteriorated.

Modern construction in New Zealand relies heavily on plasterboard, fibre-cement sheets, and synthetic claddings. These materials are quick to install and relatively cheap, but when they fail, they are rarely patched up. More often, they are completely removed and sent to landfill. Construction and demolition waste is estimated to make up 40–50% of the nation's landfill volume. Although much of this material could theoretically be recycled, it is often discarded in practice. This pattern may imply that the choice of materials also reflects a decision about whether a building is meant for renewal or disposal.

In contrast, some materials seem to offer significantly longer service lives. Stone, hardwoods, copper, and engineered timber tend to resist decay and can often be repaired or reworked rather than replaced completely. A limewashed façade, for example, can be refreshed with just a brush and a bucket of lime every decade or two. Timber weatherboards can be replaced one by one without disturbing the entire wall. Copper roofing develops its own protective patina and may last for many decades without needing attention. These examples suggest that durability in buildings often depends not on avoiding maintenance, but on using materials that encourage simple, regular acts of care.

The way materials are joined together also seems crucial. A stone wall laid with lime mortar can be taken apart and rebuilt when needed. The same wall set in Portland cement is more prone to cracking, trapping water, and resisting repairs. A timber beam fixed with bolts or nails can be replaced, while one glued with adhesives is likely to end up in landfill once damaged. In this sense, the method of assembly may be just as important as the material itself in influencing how a building can be repaired.

New Zealand's climate and geography only heighten this urgency. Damp conditions, seismic activity, and coastal exposure can speed up decay, and poorly detailed materials may fail much sooner than expected. However, historic examples show another way. The Ōamaru stone façades of Dunedin, Auckland's kauri villas, and the timber churches scattered across rural towns still stand. Their survival appears to depend not

only on the durability of materials but also on the fact that they can be patched, coated, and repaired in cycles manageable by everyday owners.

The limitations often associated with older building methods are not insurmountable. Let's take an extreme example: a damp stone barn may once have been draughty, cold, and challenging to inhabit; yet, with modern systems, it can become a warm, dry, and efficient home. A large heat pump connected to a renewable energy source, for instance, can transform a heavy masonry shell into a comfortable dwelling with relatively little environmental impact. This suggests that the endurance of traditional materials does not have to come at the expense of liveability. Instead, by combining low-maintenance, repairable materials with contemporary environmental technologies, it may be possible to retain the strengths of past construction while addressing its former weaknesses.

This section explores ideas around materials with these principles in mind. It starts by examining recyclability, questioning how materials can be reintroduced into useful cycles after their initial lifespan. It then takes a closer look at stone and timber, two materials with long histories of repair and renewal, before moving on to metals, glass, concrete, and earth. The chapter concludes by proposing an approach to selecting materials that prioritises repairability, serviceability, and long-term durability. The aim is not to set a fixed list, but to consider how carefully chosen and detailed materials can enable homes to remain viable for generations.

04.01. Recyclability

If a home is expected to last for two centuries, it seems reasonable that its materials should be able to survive more than one cycle of use. Recyclability may be one of the most important measures of this. Once a material has served its purpose in one form, it should ideally be recoverable and reusable in another. Where this is not the case, the building risks becoming a future waste burden rather than a durable asset.

Some distinctions are clear. Materials composed of a single substance, such as stone blocks, timber boards, or copper sheets, are far more likely to be recovered and reused. Composite products, by contrast, often combine different substances in ways that make separation impossible. Fibre-cement sheeting and plasterboard are typical examples: inexpensive to install, but with little or no pathway once removed. In practice, they almost always end up in a landfill. This suggests that avoiding composites, wherever possible, may be a prerequisite for long-lived construction.

Even among recyclable materials, there is a distinction between downcycling and genuine recycling. Concrete rubble can be crushed and reused as fill, but this is not the same as restoring it to structural concrete. Stone, on the other hand, can often be cut down and repurposed, maintaining much of its original strength. Metals appear to provide the most dependable recycling options: steel can be melted and reshaped

endlessly, and copper can circulate almost forever without losing its properties. Aluminium, however, is more complex: its initial production consumes a lot of energy, yet once in use, it can be recycled at a fraction of that cost. The implication is that while embodied energy is significant at the start, the ability to recycle repeatedly may justify the investment over the long term.

Timber follows a slightly different cycle. While it cannot be endlessly recycled in the industrial sense, it can often be re-milled into smaller sections, reused in secondary construction, or turned into furniture. Ultimately, it may be composted or used as fuel. This final stage is valuable: composting returns nutrients to the soil, closing the loop in a way that reflects natural growth cycles. Over two centuries, a timber element may serve many roles, gradually working its way down through the building until it returns to the earth.

Glass highlights some limitations of recycling. Clear glass can be melted down again, but toughened and laminated safety glass, increasingly used in high-performance windows, is rarely accepted by recyclers. In a home designed for multiple refurbishment cycles, this creates a challenge. It might mean that glazing systems should be designed for replacement, with the understanding that not all glass can be recycled or reused.

Another way to consider recyclability is to view the house itself as a kind of material bank. If its structure consists of stone, timber, and metals that can be recovered and re-used, then the building holds assets rather than liabilities. Modern houses often follow the opposite approach: the land underneath appreciates, while the building itself deteriorates into an expensive shell with little or no salvage value. In contrast, a home designed as a store of recyclable materials may age differently, with its components retaining value even as they are replaced or adapted.

In New Zealand, recyclability also depends on the availability of infrastructure. Estimates suggest that 40–50% of landfill waste consists of construction and demolition materials. Much of this is technically recyclable, yet the systems to separate and process it are limited. Mixed waste streams, contamination, and transport distances often make recovery uneconomic. For this reason, a Bicentennial Home cannot rely solely on the promise that recycling will be available in the future. Materials should be detailed and assembled so that they can be disassembled, sorted, and stored without specialised equipment.

These observations suggest a simple principle: a home that aims to endure should be constructed from materials that maintain their value even after their initial use. If each component can be removed, reused, or recycled with minimal cost and energy, then the building supports a circular economy rather than undermining it

04.02. Stone

Stone has long been regarded as one of the most durable building materials, and its endurance across centuries lends support to this reputation. Buildings built with stone often last longer than those made of timber or lighter materials, sometimes standing long after the communities around them have moved on or vanished. In the New Zealand context, the Ōamaru stone facades of Dunedin, the sandstone of Auckland, and the schist walls of Central Otago are examples of masonry that have withstood more than a century of weathering. These examples demonstrate that stone, when used properly, can serve as a dependable foundation for buildings designed to last.

The appeal of stone partly comes from its durability and its resistance to fire, pests, and decay. Unlike timber, stone won't rot when wet, nor is it vulnerable to termites. A wall of solid stone can endure decades of rain and wind with only surface erosion, which often adds character rather than reducing its function. This doesn't mean stone is invincible. Softer types, such as Ōamaru limestone, are known to weather quickly under the influence of acid rain or salt exposure. In such cases, longevity depends on how well the stone is detailed and maintained. Repointing joints, applying limewash, and replacing individual blocks are usually enough to extend the life of these structures greatly.

Repairability can be seen as one of stone's greatest strengths. A wall constructed with lime mortar, rather than Portland cement, can be taken apart and reassembled as needed. Cracked blocks can be recut and rotated, enabling them to serve new functions. This reversibility indicates that stone is not only built to last but also aligns with a philosophy of continual refurbishment. In contrast, when stone is set in hard cement mortars, its repair capacity diminishes. Cement tends to trap moisture, speed up decay at the edges, and make replacement tricky without harming the surrounding structure. The key lesson is that how stone is assembled matters as much as the material itself.

Modern technology enables stone to be used in ways that were less practical before. Ventilated stone rainscreens, for example, detach the structural frame from the cladding, allowing the stone to breathe and reducing moisture build-up. This approach also keeps the stone accessible: individual panels can be removed and replaced without disturbing the entire wall. Dry-stacked systems combined with steel or timber frames may further enhance seismic resilience, addressing one of the traditional weaknesses of heavy masonry in earthquake-prone regions. These innovations suggest that stone can be adapted to meet contemporary performance needs while maintaining its inherent longevity.

It may also be that the strengths of stone in contemporary housing are not yet fully recognised. Because it is seldom used in modern residential buildings, architects have had limited chances to experiment with new forms, details, and assemblies. As a result, stone is often evaluated based on its historical uses rather than

its future potential. Suppose architects and builders engaged more directly with stone within modern performance standards. In that case, other benefits might surface in thermal mass control, acoustic performance, or even new types of modular prefabrication. The unfamiliarity of stone in current housing may hide qualities that only become clear once it is deliberately reintroduced into design practice.

Maintenance practices remain key. Limewash, for example, can be applied by hand every decade or two to safeguard and renew surfaces. The simplicity of this task, needing little more than a brush, a bucket, and some time, makes it accessible to non-specialists. In this way, stone aligns with the idea of a Bicentennial Home: longevity supported not by professionals but by ordinary, repeatable acts of care. A wall that can be washed, patched, and repointed by its owners is far more likely to last than one that requires costly specialist intervention each time it slips or deteriorates.

There is also a practical economy to stone. Because it is heavy and difficult to dispose of, it is rarely regarded as waste. Blocks that are no longer suitable in one setting often find use in another, whether as aggregate, landscaping features, or retaining walls. In this way, stone appears to function almost naturally as part of a circular economy. The material resists being thrown away, which may explain its frequent reuse across generations.

Of course, there are limits. Quarrying stone has an impact on the environment, and transporting it over long distances involves both financial and for the immediate future a carbon costs. For this reason, stone is most suitable where it is locally available rather than imported, but this may not be a huge limiting factor, as stone is already in most places where one might be building. A singular stone building method seems less suitable as a universal solution and more as a regional one, linked to the local geology. When used appropriately, however, it can provide one of the simplest ways to build structures that last for centuries.

Taken together, these observations suggest that stone is not just a symbol of permanence but also a material suited for maintenance and renewal. Its strength lies in its capacity to be repaired, adapted, and repurposed without losing its value. A lime-washed wall, a rainscreen panel, or a dry-stacked course all show how stone can remain useful through cycles of change. In a Bicentennial Home, this ability to endure through serviceability might be its most valuable trait.

04.03. Wood

Timber has always been central to building in New Zealand, and its qualities suggest it will continue to play an important role in durable construction. Houses built from kauri, rimu, and tōtara more than a century ago still stand, often with their original structure intact. These examples show that wood, when properly detailed and maintained, can provide a reliable framework for homes built to last.

The benefits of wood are obvious. It is renewable, readily available, and easy to work with. Unlike stone or concrete, it is lightweight and can bend during seismic events, making it particularly suitable for New Zealand conditions. Timber also has cultural familiarity: it is the material most homeowners feel comfortable repairing themselves, whether replacing a weatherboard, sanding a floor, or oiling a deck. This familiarity lowers the barrier to maintenance, which can be as important for longevity as the material's technical qualities.

Timber, however, has weaknesses that must be managed. Left unprotected, it will rot when wet, and untreated sections can become vulnerable to insects. Fire is another clear hazard, and regulations often restrict the amount of exposed structural timber that can be used in public or multi-storey buildings. Chemical treatments can mitigate some of these risks but also pose their own environmental and health concerns.

A further complication lies in the treatments themselves. To improve durability, especially in exposed conditions, timber is often impregnated with copper, chromium, or other chemical preservatives. While these protect against decay and insects, they also limit timber's circular lifespan. Treated wood cannot be safely composted, and recycling streams are reluctant to accept it due to contamination. In practice, much treated timber ends up in landfill once removed. Suppose wood is to remain central to a circular economy. In that case, more attention needs to be given to treatments that protect during service without preventing reuse, recycling, or safe return to the soil.

Part of the problem may be that timber has become the default material in New Zealand, asked to perform roles for which it is not best suited. When used in areas of constant dampness or direct ground contact, decay is almost inevitable, and chemical treatments are often applied as a compensatory measure. If timber were used more selectively, in combination with stone, metals, or earth, where each material performs best, its lifespan might be naturally longer, even without treatment. This suggests the limits of timber may lie less in the material itself than in the way it is applied. With more deliberate pairing of materials, wood could retain its renewable and repairable qualities while avoiding treatments that currently close off circular pathways.

Maintenance cycles are crucial for timber's durability. Claddings and linings can be designed as replaceable parts, attached mechanically rather than glued, allowing individual boards to be swapped when damaged. Surfaces can be refreshed with paint, oil, or stains roughly every ten years, tasks that homeowners can manage without calling in specialists. Floors, too, can be sanded and refinished multiple times throughout the life of a building. These maintenance routines indicate that timber can last for centuries not because it is completely resistant to decay, but because it can be maintained and tolerated through manageable steps.

Engineered wood products may extend this concept further. CLT, LVL, and glulam beams integrate fast-growing plantation pines into large structural components that can span distances once reserved for concrete or steel. Their application in projects like the Nelson Airport terminal indicates that engineered timber can meet modern performance standards while still embodying the flexibility and reparability of wood. These systems are still relatively new in New Zealand, and their long-term behaviour remains uncertain. However, it is reasonable to suggest that, if designed for disassembly and protected from moisture, they could provide a renewable backbone for multi-storey housing.

What appears more uncertain is whether engineered timber can fully align with a circular economy. The strength and size of CLT or LVL panels make them attractive, but the adhesives and treatments used to bond them might complicate their end-of-life options. Panels glued with synthetic resins are hard to separate, and chemical treatments can limit recycling or safe disposal. In this way, the role of engineered timber in a repairable and recyclable building culture may depend less on its strength than on how it is glued, finished, and detailed for easy disassembly.

Looking overseas provides further reassurance. Traditional Japanese houses, such as Minka and Machiya, often last for two centuries or more, but only because they are regularly maintained, including re-roofing, replacing infill panels, and re-oiling joinery. Similarly, Norway's stave churches, some of which have stood for nearly a thousand years, endure because their components are replaced as they age, rather than being left to fail. These examples suggest that longevity in timber is not an inherent trait but the result of ongoing cycles of care.

For New Zealand, this could point towards a future of modular timber cassettes and component-based systems. Floor, wall, and roof panels might be designed to be replaced every few decades, much like weatherboards or shingles have been historically used. Clip-in linings and floorboards would enable homeowners to refresh worn parts without disturbing the main structure. If these ideas are adopted, the Bicentennial Home could use timber not just as a material but as a practical system, where every part has a clear route for maintenance, replacement, recycling, or composting.

There are, of course, limits. Timber's carbon benefits depend on responsible forestry, and excessive reliance on fast-growing pine may threaten biodiversity and long-term durability. Treatments to prevent decay can extend service life but might complicate recycling or disposal later. The use of large, engineered elements, while promising, could trap timber into forms that are harder to re-use than simpler boards and beams. These uncertainties mean that the future of timber in long-lasting housing will require a careful balance of scale, treatment, and detailing.

The evidence so far seems to show that timber remains one of the most versatile and repairable materials available. Its light weight, renewability, and cultural familiarity make it especially suitable for a housing tradition that relies on user-led maintenance. Replacing a weatherboard, refinishing a floor, or swapping out a structural element all highlight how timber endures through cycles of change. In a Bicentennial Home, this ability to be worked on rather than resist decay until sudden failure might be timber's greatest trait.

04.04. Other Materials

Not every part of a building can be made from stone or timber. Other materials inevitably find their place, whether for structure, cladding, glazing, or finishes. The question is not whether they should be used, but how they might be chosen and detailed so that they support, rather than undermine, a building's long life.

04.04.1. Metals

Metals provide some of the most dependable pathways for recycling. Steel, for example, can be melted down and remoulded endlessly, maintaining its structural qualities. It also supports modular construction, allowing bolts and welds to be removed, components to be replaced, and scrap metal to be recycled back into the steelmaking process. However, its vulnerability in New Zealand lies in exposure. In coastal environments, steel will rust quickly unless it is adequately protected. Cycles of galvanising, painting, or cladding are part of its regular maintenance. Its longevity depends less on the steel itself and more on a commitment to maintaining its protective coatings.

Copper offers a choice. Its high-cost limits widespread use, but it provides unique benefits. It develops a natural patina that guards against corrosion, and once installed, it can last for many decades without needing further treatment. Roofing and cladding made from copper require only time to stabilise. Like steel, it is endlessly recyclable. This indicates that, if budgets permit, copper might be one of the least demanding long-term options, especially for elements exposed to the weather.

Aluminium occupies a more ambiguous position. It is lightweight, widely available, and endlessly recyclable, but its thermal performance in joinery has often been poor. Thermal breaks and modern glazing systems mitigate this weakness, but aluminium frames remain vulnerable to seal failure over time. Here, the recyclability of the metal may be an advantage, as joinery can be disassembled and melted down. The limitation lies not in the aluminium but in the glass sealed into it.

04.04.2. Glass

Glass highlights the tension between performance and recyclability. Clear float glass can be remelted, but toughened and laminated glass, now standard for safety and insulation, are rarely accepted in recycling streams. This may mean that windows are among the more disposable elements of a house, with

replacement cycles every few decades as seals fail. Designing frames that allow glass to be swapped easily, and planning for safe storage or downcycling, may be the most pragmatic approach. While glass brings light and connection, it also represents one of the more vulnerable links in a 200-year home.

04.04.3. Concrete

Concrete remains one of the most widely used materials in construction, mainly due to its strength and versatility. However, its dependence on Portland cement makes it a carbon-intensive material, and its repairability is limited. Once cracked, it is hard to patch without creating weak spots, and once demolished, it is at best downcycled into aggregate fill.

There is also a persistent modern myth that concrete is inherently long-lasting. The examples of Roman concrete, which have endured for centuries, are often cited to support this view. Yet modern concrete, particularly reinforced concrete, does not seem to share the same durability. The steel reinforcement within tends to corrode, expand, and crack the surrounding matrix, leading to structural failure. In practice, many reinforced concrete structures have a working life of only a few decades, sometimes as little as 50 years, before major repairs or replacements, or, commonly, demolition is necessary. This indicates that modern concrete may be less permanent than many people assume.

Alternatives like limecrete, geopolymer binders, or concrete with recycled aggregates may lower environmental impacts, but they still do not address the core challenge of recycling concrete for structural use. Modular precast elements could enhance repairability by enabling individual parts to be replaced rather than demolished. However, this only solves the issue of replacement, not recyclability. Like timber, the deeper problem might be in treating concrete as a default material in situations where it is not the most suitable option. All of this suggests that concrete should be a secondary rather than primary choice within the Bicentennial Home framework. When used, it should be carefully designed for disassembly, ensuring it supports long-term construction and does not restrict future occupants to demolition.

04.04.4. Earth & Clay

Earth-based materials like rammed earth, adobe, and clay plaster provide a different kind of durability. They are low in embodied energy, readily available, and highly repairable. A clay plaster wall can be patched with just water and soil, and a lime or clay wash can be reapplied by hand every few years. This cycle of low-skill maintenance makes earth finishes especially suitable for a Bicentennial Home. They are not meant to last forever but instead encourage ongoing care. Rammed-earth walls, though bulkier, can also last a long time if protected from water ingress. The weakness of Earth is less about tech and more about culture: it's rarely used in mainstream building, so its full potential is often ignored.

04.04.5. Composites

By contrast, many modern composite products like fibre cement, plasterboard, and vinyl claddings seem to embody the opposite of repairability. They are quick to install and inexpensive, but once damaged, they are rarely repaired. They cannot be separated into recyclable streams, and their afterlife is almost always landfill. In this sense, they represent a liability rather than an asset. While they may meet short-term economic needs, their presence in a Bicentennial Home would undermine the idea of a house as a material bank.

03.04.6. Other Materials Ethos

These observations suggest that other materials need to be incorporated thoughtfully. Metals can serve as long-lasting, recyclable elements if their protective coatings are maintained, with copper requiring the least intervention and steel needing regular attention. Glass provides light and comfort but is likely to remain a short-lived component, with laminated and toughened products rarely recycled. Concrete, despite its reputation for durability, often proves fragile in modern reinforced forms; it may only be suitable for long-lasting construction when used sparingly. Earth-based finishes emphasise a different approach, where cyclical, low-skill maintenance becomes a strength rather than a weakness. Composites, by contrast, resist repair and recycling, offering little to a building aiming to last generations.

A Bicentennial Home cannot rely solely on stone and timber, but when other materials are used, they should be those that can be maintained, repaired, or returned to circulation at the end of their lifespan. Otherwise, the building risks repeating the short-lived patterns of modern construction.

04.05. Conclusion

The assertion of this project is that material selection is a secondary factor in a home's durability; what matters more is repairability and a material's capacity to be maintained. A building designed to last two centuries does not require materials that never change, but those that can be renewed, adapted, and recirculated once their initial purpose has been fulfilled.

Stone demonstrates how endurance and repairability can complement each other. Its presence in New Zealand towns for over a century shows that, when combined with lime mortars and accessible detailing, it can be dismantled, reset, and maintained across generations. Modern systems like rainscreens or dry stacking might offer additional benefits that are yet to be fully explored.

Timber offers a different approach: adaptability through routine cycles of care. Weatherboards, floors, and linings can be replaced or refinished in small steps, making the material suitable for ordinary, low-skill maintenance. The issues with chemical treatments and overuse in inappropriate settings suggest that timber should be used more selectively, preferably alongside stone, metals, or earth. Engineered timber shows

promise, but its role in a circular economy depends on adhesives and finishes that do not send it to landfill at the end of its life.

Other materials contribute unevenly. Metals like steel and copper can circulate indefinitely if their protective systems are adequately maintained. Glass offers light and comfort but is short-lived, and laminated products are rarely recyclable. Concrete illustrates how assumptions of permanence can be misleading: while Roman structures have endured, modern reinforced concrete often lasts only a few decades before requiring repair or replacement. Earth-based materials emphasise the value of cyclical, low-skill maintenance, whereas composites appear to undermine longevity altogether, as they are challenging to repair or recycle.

Taken together, these findings highlight a material ethos based on practicality rather than permanence. A Bicentennial Home is unlikely to depend on a single perfect material. Instead, it may rely on a carefully balanced palette, where each material is used where it performs best, and where joints, finishes, and detailing anticipate cycles of care and replacement. In this way, longevity becomes less about resisting change and more about embracing it through continuous, everyday acts of maintenance.

Chapter 05: Typology of New Zealand Housing Stock

05.00. Introduction

New Zealand's housing history reveals changing settlement patterns, materials, and ideas of comfort. It began with timber cottages on large plots, then moved to villas and bungalows, followed by state housing, post-war suburbs, and now denser townhouses and apartments (Schrader, 2005; Thorns, 2017). Each stage reflects shifts in land use, labour, and lifestyle, with density influenced by transport and planning (Thorns, 1986; Thorns, 2002). House sizes increased and later decreased (Goodyear, 2020). Building techniques shifted from simple open frames to layered systems within the NZ code environment (Standards NZ, 2011; MBIE, 2025). These developments explain why some houses remain easy to repair, while others are more disposable in practice (MBIE, 2014b).

05.01. New Zealand Housing History

The first wave of colonial settlement from the 1840s to 1900 produced small timber houses on large plots. Sections were spacious, and homes were detached. Most were single storey with simple rectangular layouts and verandas. Weatherboards, corrugated iron, and local timber were the primary materials. Floor areas were usually between sixty and one hundred square metres. Families extended houses with lean-tos or rear rooms. Construction was straightforward and done by hand, so boards and sashes could be replaced individually. This made early houses adaptable despite low settlement density (Schrader, 2005).

From about 1880 to the 1930s the villa became the dominant suburban type as rail and tram routes spread. The quarter-acre section became the norm. Villas faced the street with verandas and used a central hall with rooms to each side. They were larger than earlier cottages, often one hundred and thirty to one hundred and fifty square metres. Tall ceilings improved ventilation and daylight. Timber frames and ventilated cavities kept maintenance regular but simple (Schrader, 2005). Compact railway cottages also appeared near yards and stations, setting early worker-housing patterns at slightly higher density (Schrader, 2005). Many villas had a straight hallway through the centre, which later made rear extensions and new service rooms easy to add (Schrader, 2005).

The period between the wars saw changes in both style and policy. The bungalow replaced the villa in many suburbs. Large state-housing projects began in the 1930s. Sites were smaller but still generous. Bungalows reduced ornament and simplified layouts. State houses were more compact again, with clear plans and separate service rooms. Floor areas typically ranged from eighty-five to one hundred square metres. Timber framing with iron or tile roofs and standard parts aged well. Scale and clarity made renovation

straightforward; insulation, wiring, and heating could be added without significant structural change (Schrader, 2005).

From 1945 to 1960 prosperity and car ownership reshaped suburbs. Cities were still young, and public transport was easy to cut back. Tram lines were removed. Auckland's electric trams ended in 1956, and motorway building then dominated (Duncan, 2021). Wellington closed the country's last electric tramway in 1964 (New Zealand History, 2020). Christchurch wound down its network through the 1950s and shifted to diesel buses (Christchurch City Libraries, 1998). Rail investment slowed while motorways and arterial roads took priority. Zoning separates homes from shops and jobs. Parking became a basic standard. Land on the outskirts opened for development as the car covered distance. Sections were moderate. Many houses stayed single-storey and detached. Plans turned to gardens, driveways, and garages.

From the 1960s to the mid-1980s, the car model settled in. Subdivision patterns followed new roads. Cul-de-sacs and loops multiplied, which made bus routes harder to serve (Thorns, 2002). Typical lots were six to seven hundred square metres. Houses covered a growing share of each plot. Floor plans emphasised indoor-outdoor flow, larger living rooms, and garages. Materials shifted toward plasterboard, sheet claddings, and aluminium joinery. House sizes often exceeded one hundred and forty square metres. Density stayed low because houses remained detached. Structures were still timber but relied more on factory-made components as NZS 3604 systems matured (Isaacs, 2009; Standards NZ, 2011).

From the late 1980s to the early 2000s, suburban growth moved to smaller infill lots. Multi-level houses and intricate roof forms became common. Fashion favoured plastered façades with tight junctions. Average floor areas rose to one hundred and fifty to two hundred square metres, even as lots shrank. This often did not lift effective density per person because empty bedrooms added capacity on paper only (Thorns, 2000; Goodyear, 2020). Construction systems became less accessible. Sealed claddings and proprietary junctions made repairs difficult. Moisture failures, known as the leaky-homes crisis, led many houses to require full recladding or replacement (Hunn, Bond, & Kernohan, 2002; Easton, 2010; Dyer, 2019; PricewaterhouseCoopers, 2009).

05.02. Modern Trends

Over the last two decades, development has shifted inward. Policies emphasise compact growth around centres and public transit, often clashing with street designs built for cars. Long blocks and disconnected paths slow the move toward walkable density (Thorns, 2002). In Auckland, Wellington, and Christchurch, townhouses and small apartments are increasingly common, with densities of thirty-five to sixty-five dwellings per hectare, compared with ten to fifteen in traditional suburbs (Wellington City Council, 2025; Christchurch City Council, 2018). Outdoor spaces are smaller, and parking is often shared or on-street.

This inward focus also correlates with high demolition rates as older houses are torn down and replaced, which increases construction and demolition waste (MfE, 2023; OurAuckland, 2019; SBN, 2023a). In inner suburbs such as Grey Lynn, many repairable villas and bungalows are removed for higher yield (Schrader, 2005). Recent Auckland terrace schemes commonly deliver net densities around the low-forties dwellings per hectare, with councils using net-to-gross conversions to report area averages (WOODS, 2020).

Two-bedroom units typically range from ninety to one hundred and twenty square metres, while one-bedroom layouts are smaller. Detached houses on the outskirts tend to be larger, about one hundred and fifty to one hundred and sixty square metres (Goodyear, 2020). Floor plans are compact and vertically stacked, with wet areas aligned for efficiency. Construction continues to use light timber framing, now with more layers of membranes, rigid barriers, and proprietary façades. Prefabricated panels are increasingly common. Build times improve, but these systems rely on precise installation and documentation (MBIE, 2021; MBIE, 2025).

These trends mark the most significant change in urban form since the state-housing era. The general pattern is a move back toward higher density after many years of sprawl. Construction culture continues to prioritise cost and speed, resulting in smaller homes arranged more closely together. Envelopes are intricate and perform well when maintained, but they require planned upkeep to remain effective (MBIE, 2014b).

05.03. Current Integration with Repairability

Repair potential varies with age and assembly. Early timber cottages and villas are highly repairable because parts are accessible and replaceable (Schrader, 2005). Mid-century bungalows and state houses share this trait and have accepted multiple waves of retrofit for insulation, heating, and interior upgrades (Schrader, 2005). Post-war suburban houses keep a serviceable frame but often use sheet claddings and finishes that do not come apart cleanly and may contain asbestos. Planned maintenance within the code regime is essential (MBIE, 2014a; MBIE, 2014b). Houses from the plaster-clad era are the least forgiving. When water enters, large areas usually need to be removed at once (Hunn, Bond, & Kernohan, 2002; Dyer, 2019).

Contemporary multi-unit housing offers better energy efficiency and comfort but relies on layered envelopes that need consistent detailing. Maintenance is collective rather than individual. Shared walls and roofs are managed by bodies corporate and long-term plans under the Unit Titles framework (Unit Titles Act 2010; NZ Legislation, 2010a; NZ Legislation, 2010b; MBIE, 2024a; MHUD, 2025). Outcomes depend on coordination and funding as much as on materials.

Across all eras, density and ownership structures shape repair processes. Detached houses rely on individual owners. Townhouses and apartments rely on groups. Both models work when responsibilities are clear and

funds are available (NZ Legislation, 2010a; NZ Legislation, 2010b). The physical layout sets the foundation, while management determines how smoothly properties age over time (MBIE, 2014b).

05.04. Conclusion

New Zealand's housing landscape has evolved, becoming more diverse and, in recent years, denser. Small cottages on large plots gave way to villas and bungalows, then to state houses, post-war suburbs, and speculative infill. Today, there is a trend toward compact terraces and apartment living (Thorns, 2002). House sizes have fluctuated, and density levels have shifted (Goodyear, 2020). Materials and detailing have moved from open timber systems to layered envelopes within NZ practice (Standards NZ, 2011; MBIE, 2025). A mid-twentieth-century turn to car-oriented planning left a dispersed urban form that now sits in tension with adaptive reuse and walkable neighbourhoods (Thorns, 2017; Duncan, 2021; New Zealand History, 2020; Christchurch City Libraries, 1998). Later sections will explore this tension and its implications for a design-for-renovation approach using New Zealand policy and technical guidance (MBIE, 2014a; MBIE, 2014b; MBIE, 2025).

Chapter 06: Case Studies

06.01. Case Studies

This chapter explores case studies to demonstrate how housing longevity functions in real-world situations. While previous chapters laid out the theoretical and technical foundations for repairability, adaptability, and custodianship, these examples show how these principles are applied in actual buildings over time. The case studies help to reveal the connection between construction methods, usage patterns, and the potential for continual repair and modification.

The chosen houses are typical New Zealand homes rather than unique or architect-designed ones. They come from various regions, eras, and conditions, enabling comparisons of different construction methods, environmental settings, and ownership histories. Hanson Street and Takinga Street were selected as main case studies because they show signs of longevity resulting from accessible building techniques, material performance, and ongoing or disrupted stewardship. Both display repairable systems and visible histories of change, making them ideal for studying how buildings adapt over time.

For each case study, drawings were produced to support this analysis. The "Peeling Away the Layers" sequences trace how the buildings have evolved over time, making visible the relationship between original construction and later modification. Through this process, the drawings reveal how change is enabled or constrained by the underlying building logic, operating as both representation and analytical tool.

06.01.1. Hanson Street: Newtown, Wellington

The Hanson Street house demonstrates how housing longevity can emerge through repair, modification, and long-term occupation rather than material durability alone. Built prior to the First World War, the home reflects a period of New Zealand housing defined by timber framing, lightweight construction, and relatively accessible building systems. As an original structure, it continues to express both the physical and cultural characteristics of early suburban development in Wellington.

The house is timber-framed and elevated above a crawl space, a configuration central to its repairability. This separation between the ground and the structure allows continued access to subfloor services and utilities, thereby supporting inspection, maintenance, and incremental upgrades. Roof-cavity access further ensures that essential systems remain accessible without requiring destructive intervention. In practical terms, the building remains workable.

Its construction logic follows a familiar New Zealand approach, where load-bearing structural elements sit alongside lightweight internal partitions constructed as gib and stud walls. Although services are largely

concealed, the overall assembly remains legible and adaptable. Linings can be removed using conventional methods, allowing modification without compromising structural stability. This capacity for intervention is reflected in the house's visible history of change. The home has undergone multiple cycles of re-planning and extension, including substantial rear additions and the introduction of a second level. These interventions are readily apparent rather than seamlessly integrated. Yet this lack of visual uniformity contributes positively to the building's architectural character, reinforcing the sense that it has been shaped over time rather than preserved as a fixed object.

The home's accumulated biography reflects the thesis argument that housing longevity is relational and cumulative. The house has been repeatedly reshaped in response to changing domestic needs without requiring wholesale reconstruction. Spatial reconfiguration remains feasible, walls can be moved where necessary, and rooms exhibit a degree of structural independence. Adaptability here is embedded within the construction system itself.

Material behaviour further supports this capacity for long-term use. Timber weatherboards and corrugated steel roofing age gradually rather than failing abruptly, enabling both repair and selective replacement. Localised issues can be addressed without destabilising the building. The largely original weatherboard cladding suggests sustained maintenance, while the re-roofing has been carried out in a like-for-like manner, reinforcing continuity.

Repair within the home is characterised primarily by targeted intervention. Elements such as windows have been replaced or upgraded without extensive demolition. Plumbing and electrical systems remain accessible, supported by the crawl space and service zones, making repair manageable and routine. This contrasts with many contemporary construction systems, where intervention often necessitates invasive and costly work.

Occupational patterns are central to the house's continued viability. Predominantly owner-occupied, the home reflects long-term custodianship rather than transient use. It presents as maintained and lived-in, with occasional patching signalling ongoing engagement. Alterations appear driven by continued habitation rather than speculative resale. The relationship between occupants and their home is reciprocal: the house adapts to its inhabitants, and the inhabitants adapt to the house. Modifications and repairs reveal an ongoing negotiation between domestic life and architectural form, positioning the home as a site of care rather than consumption.

Thermal performance, a common limitation of early timber housing, has been progressively mitigated through upgrades, including insulation and contemporary heating systems. These improvements have been achievable without fundamental reconstruction, demonstrating how performance limitations can be addressed within a repairable framework.

The house is perceived as warm and homely, characterised by the accumulated effects of age and modification. Ageing is understood to contribute to identity rather than signalling decline, whereas repair is regarded as a natural and achievable process. The Hanson Street house thus appears to be a repairable and evolving structure. Its expansion over time, accessible construction systems, and sustained patterns of care illustrate how longevity can be produced through adaptability and maintenance. Durability here is defined not by resistance to change, but by the capacity to accommodate it.

Hanson Street: Aerial View.

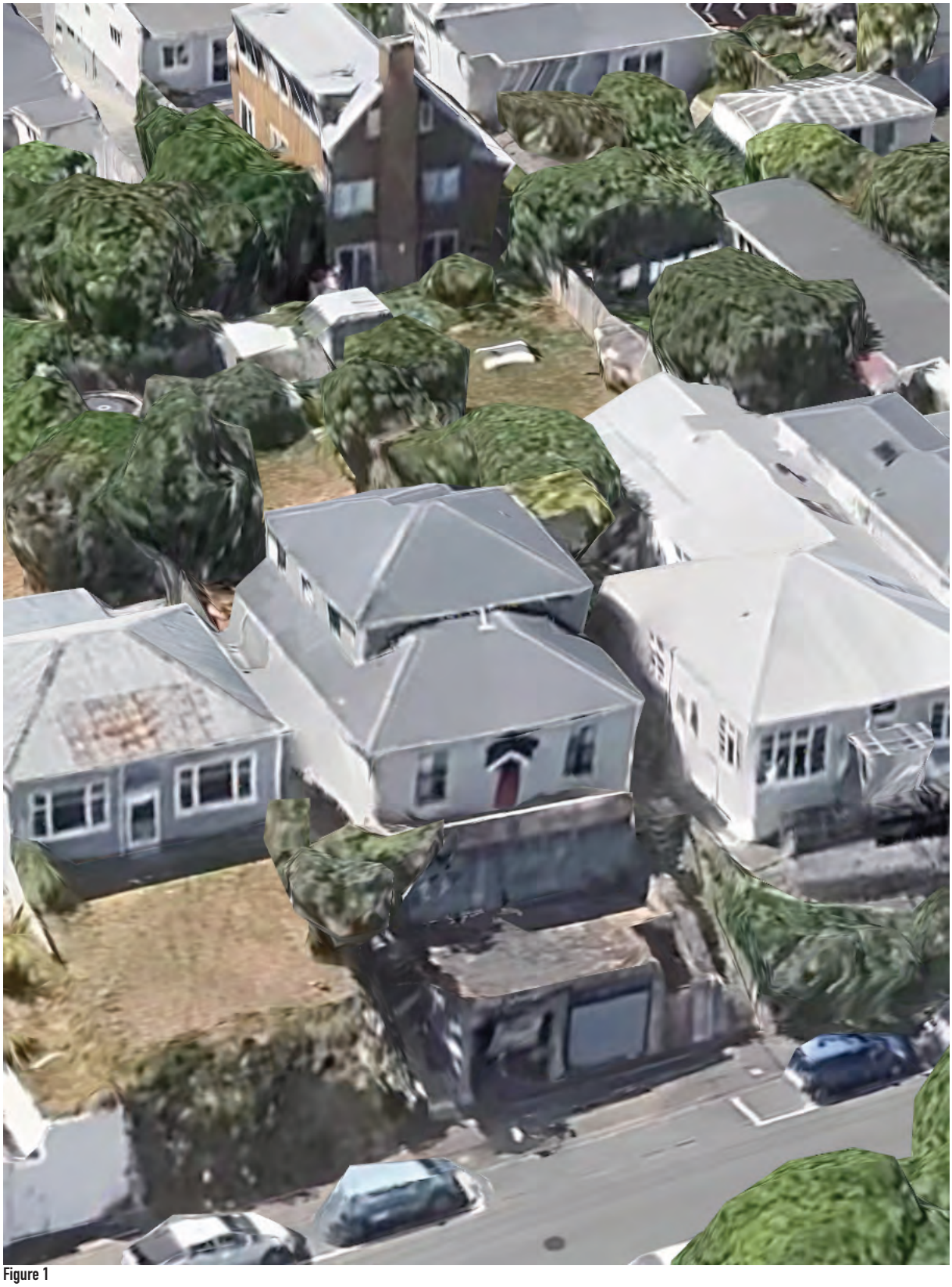
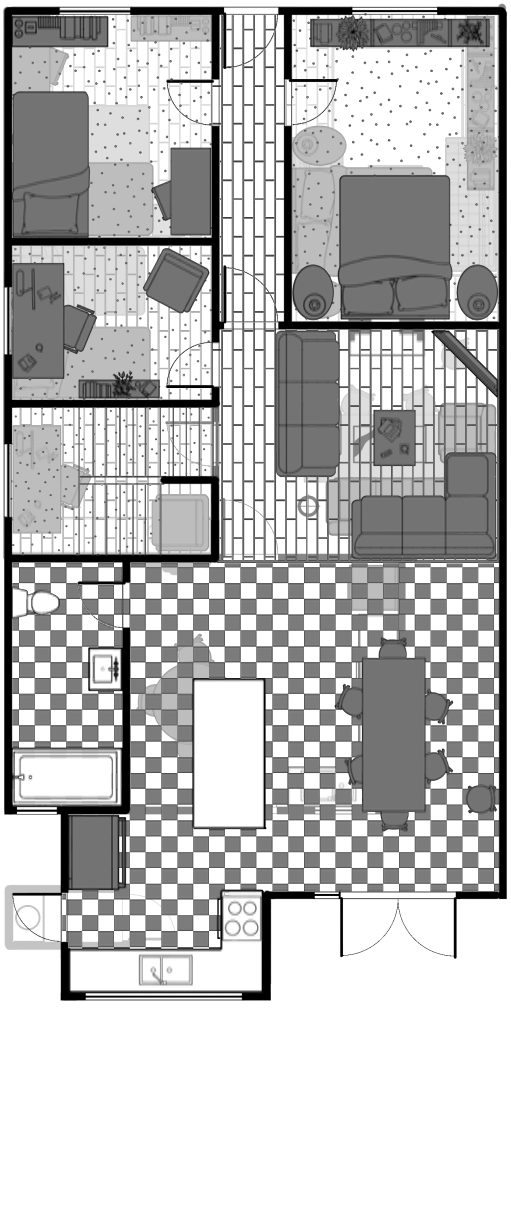


Figure 1
Aerial View: Hanson Street
Note. Image captured from Apple Maps (3D view).

Peeling Away The Layers Hanson Street: Ground Floor, Modern.



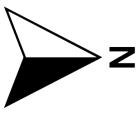
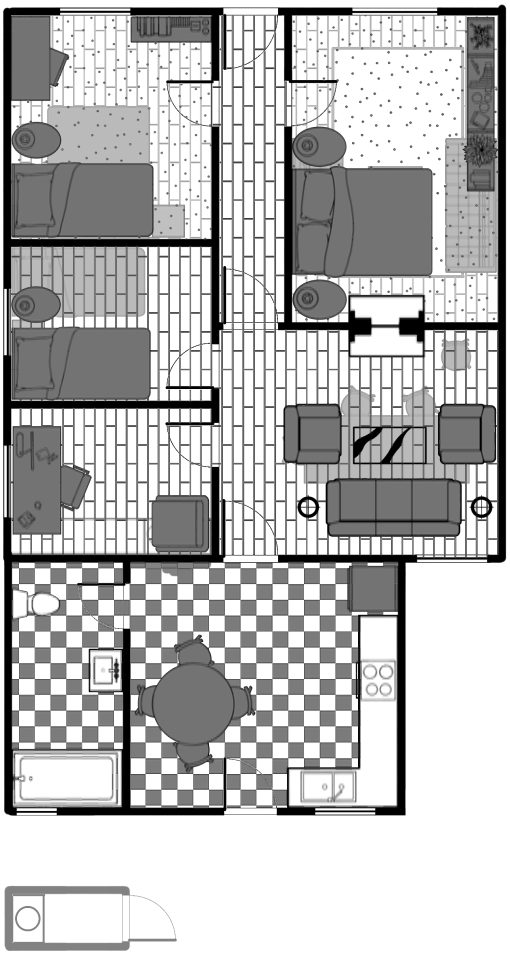


Figure 2
Peeling Away the Layers: Hanson Street. Ground Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Hanson Street: Ground Floor, Past.



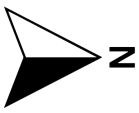
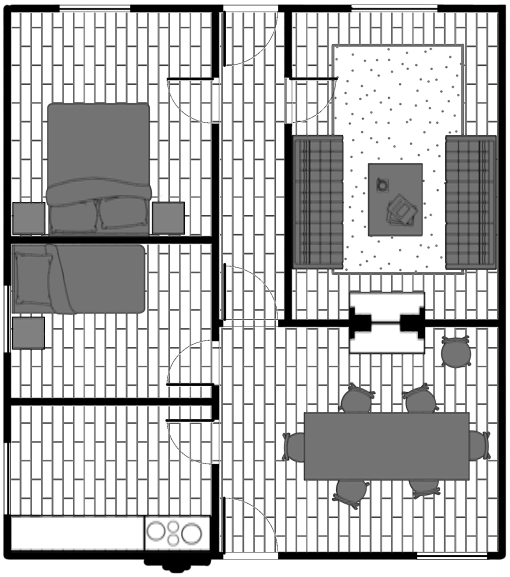


Figure 3
Peeling Away the Layers: Hanson Street. Ground Floor, Past
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Hanson Street: Ground Floor, As Built.



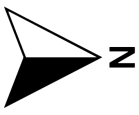
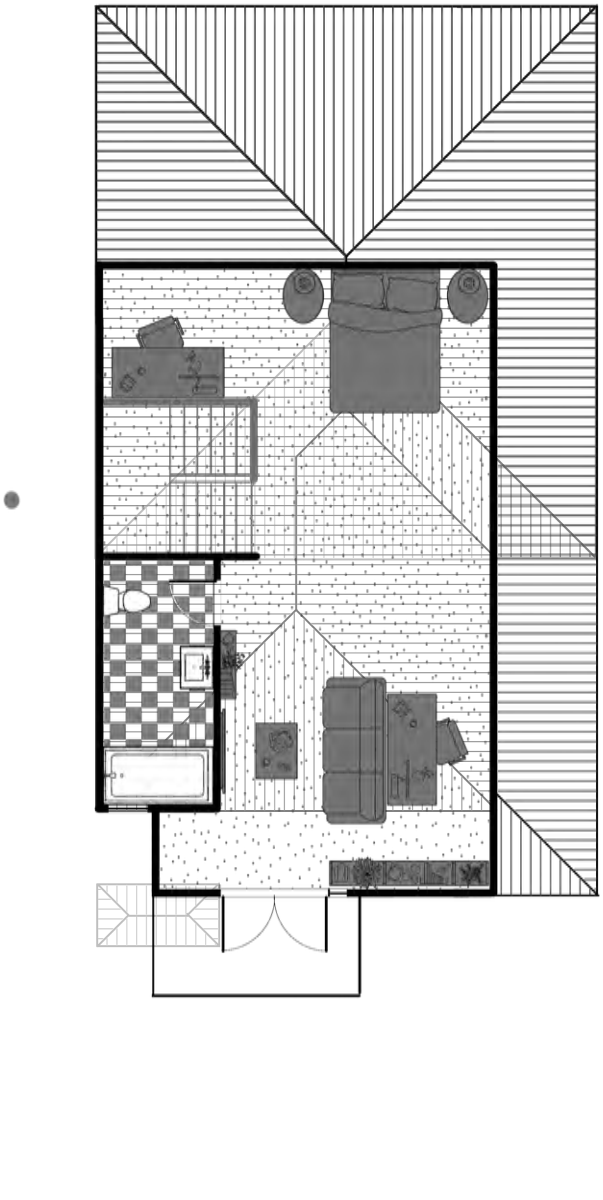


Figure 4
Peeling Away the Layers: Hanson Street. Ground Floor, As Built
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Hanson Street: First Floor, Modern.



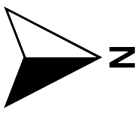
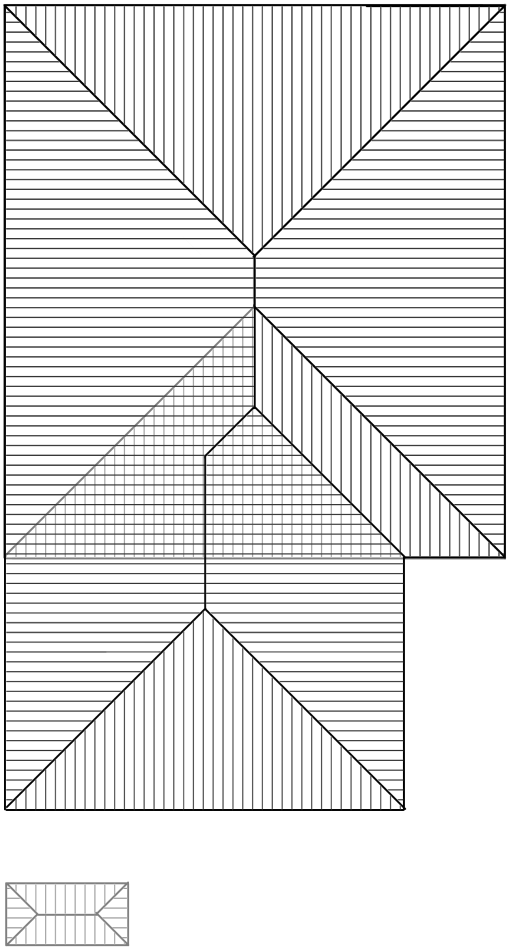


Figure 5
Peeling Away the Layers: Hanson Street. First Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Hanson Street: First Floor, Past.



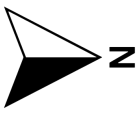


Figure 6
Peeling Away the Layers: Hanson Street. First Floor, Past
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Hanson Street: First Floor, As Built.

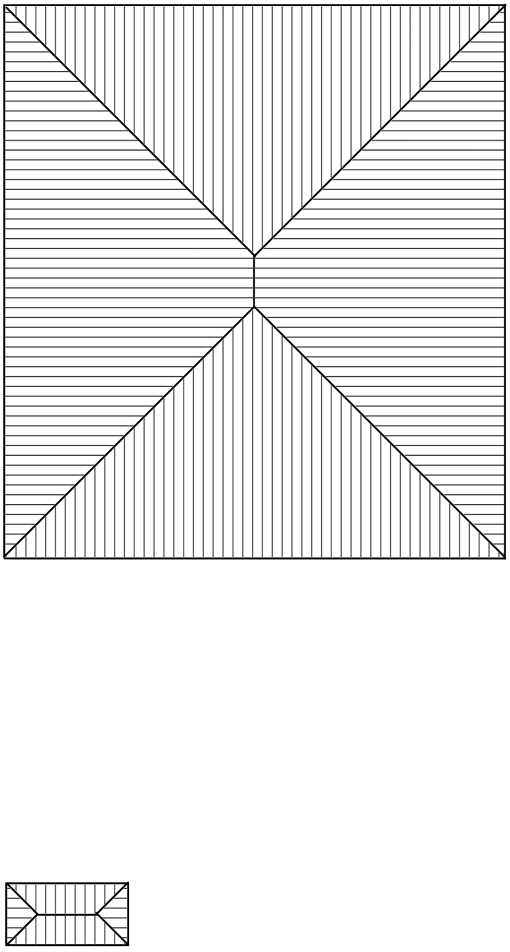


Figure 7
Peeling Away the Layers: Hanson Street. First Floor, As Built
Note. Plan drawing and illustration by the author.

Structural Diagram, Hanson Street: Ground Floor.

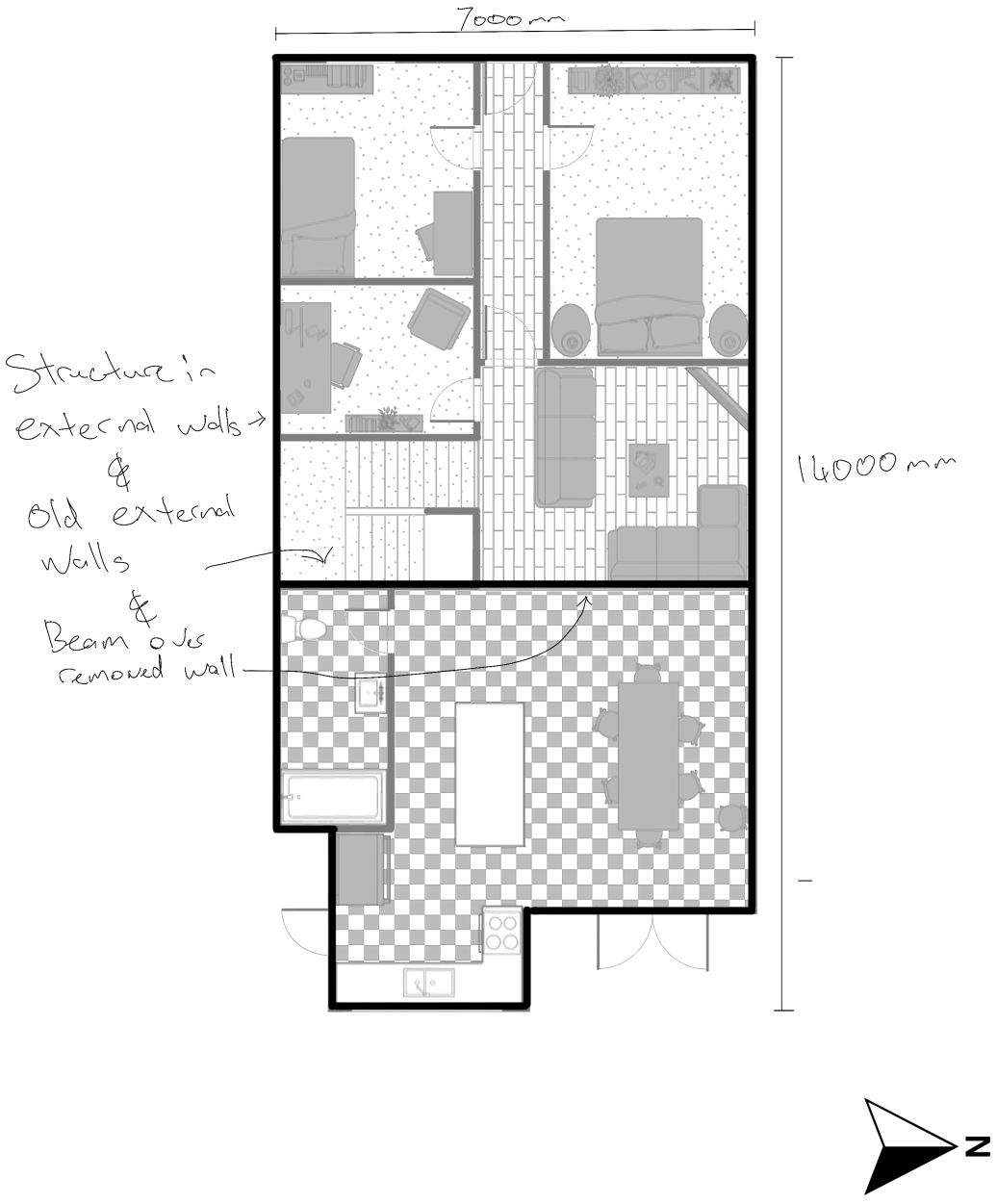


Figure 8
Structural Digram: Hanson Street. Ground Floor,
Note. Plan drawing and illustration by the author.

Structural Diagram, Hanson Street: First Floor.

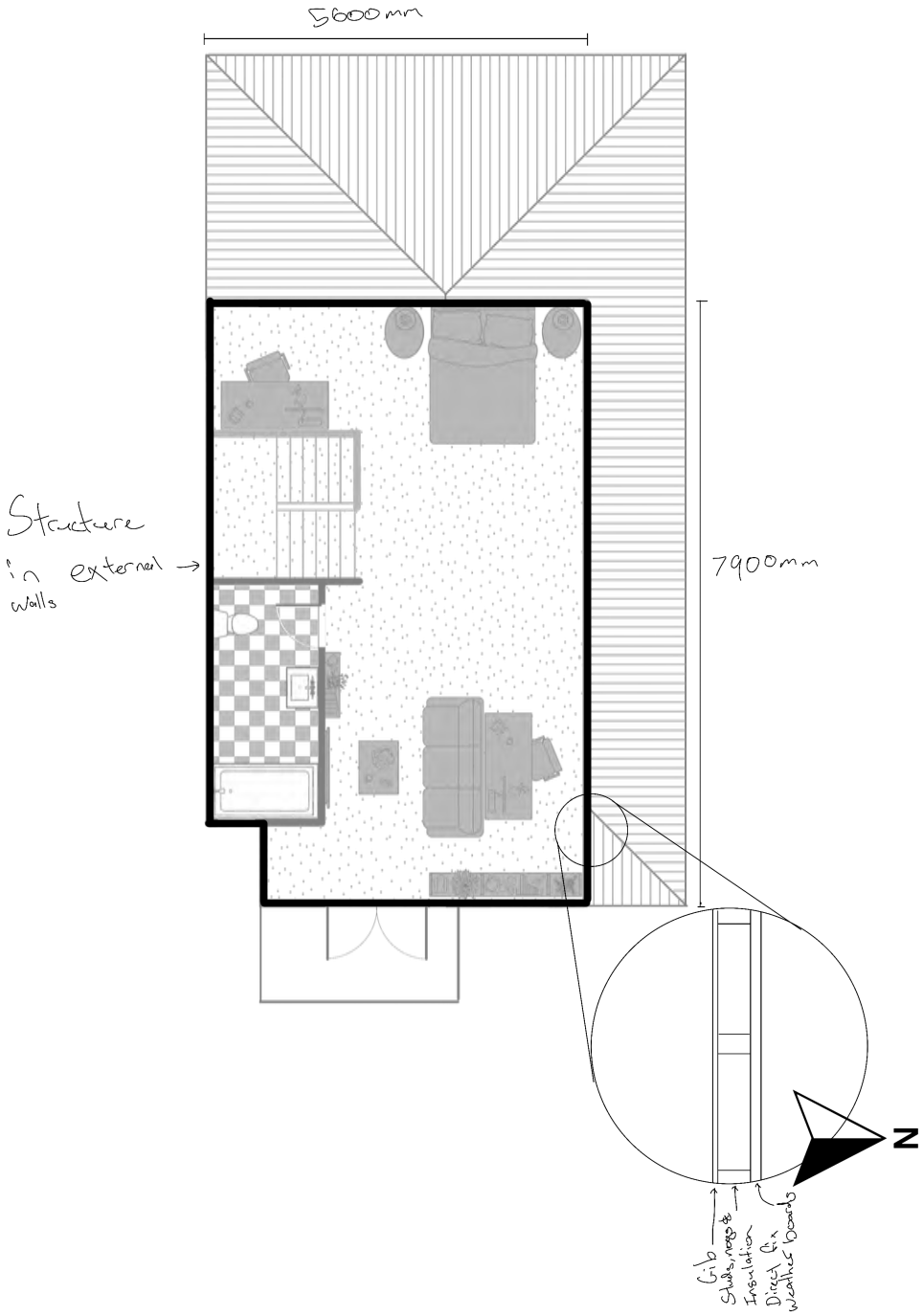


Figure 9
Structural Digram: Hanson Street. First Floor,
Note. Plan drawing and illustration by the author.

06.01.2. Takinga Street: Mourea, Rotorua

The Takinga Street house presents a different expression of housing longevity, defined less by continuous adaptation and more by periods of stability, interruption, and gradual decline. Constructed in the 1920s, the home belongs to a generation of New Zealand housing that retained many characteristics of earlier timber construction while accommodating emerging mid-century spatial expectations. As an original structure situated in Mourea, the house reflects both regional building practices and the environmental conditions of the Rotorua lakes district.

Like many houses of its era, the home is timber-framed and elevated above a crawl space. This configuration supports inspection, maintenance, and serviceability by allowing continued access to subfloor services and utilities. Plumbing and electrical systems remain accessible without significant demolition, and roof-cavity access further reinforces this repairable logic. The house follows a conventional assembly strategy in which load-bearing external walls support lightweight internal partitions. Linings can be removed using standard methods, and services are primarily located in the crawl space, which simplifies repair compared with more tightly integrated contemporary construction remaining open to modification.

Evidence of change is concentrated within a distinct mid-century phase of alteration. Extensions undertaken during the 1950s and 1960s introduced new bathrooms and auxiliary rooms, reshaping the internal organisation of the home. Takinga Street exhibits a more compressed history. The house largely reads as a combination of original fabric and mid-century interventions, with relatively limited subsequent adaptation.

While these additions appear visually seamless, their spatial consequences are more complex. The underlying planning logic was not comprehensively reworked, resulting in circulation patterns that now produce corridor-like rooms and transitional spaces. Adaptability here is shaped not only by structural capacity but by the coherence of spatial evolution.

Despite these limitations, the home retains considerable adaptive potential. Walls remain largely movable, rooms exhibit relative structural independence, and the construction system permits reconfiguration. Where constraints exist, they stem less from the building itself than from prolonged periods of stagnation and deferred maintenance. Timber remains the dominant material, supported by traditional weatherboard cladding, both of which exhibit gradual ageing patterns that favour repair over replacement. The house shows signs of deterioration associated with reduced levels of care. This condition reflects neglect rather than material failure, and the structure remains highly salvageable.

Repair within the home remains feasible. Subfloor access facilitates service interventions, while previous upgrades, including selective replacement and double glazing, demonstrate the building's capacity to

accommodate contemporary performance expectations. The house retains a structurally sound framework capable of renewal. Thermal and environmental performance present manageable points of friction. While insulation and glazing upgrades would improve comfort, these interventions remain achievable within the existing building system. Moisture challenges, influenced by the home's location on low-lying land, similarly require attention but do not constitute structural barriers.

Occupational patterns are central to the home's current condition. The house functioned primarily as an owner-occupied home until the 1990s, after which it was converted to rental use. This shift corresponds with a visible change in maintenance patterns. Where long-term custodianship previously supported care and incremental improvement, rental occupation appears to have contributed to deferred repair and gradual decline. The house thus exists within a condition of tension. Its construction system supports adaptation, yet its lived reality reflects limited investment and interrupted care cycles.

Experientially, the home is perceived as dated yet retaining a distinct charm. Interior finishes, including timber panelling, reinforce its mid-century identity. Ageing here signals suspended renewal rather than obsolescence, while repair is understood as both natural and necessary. The Takinga Street house appears to be a repairable structure shaped by unrealised potential. Its construction system, material behaviour, and spatial flexibility support continued adaptation, yet its longevity has been constrained by stagnation and shifting patterns of care. The home illustrates that repairability alone does not guarantee longevity. Sustained habitation, investment, and custodianship remain equally decisive. Durability, in this instance, is defined not by resistance to change but by the capacity for recovery.

Takinga Street:
Aerial View.

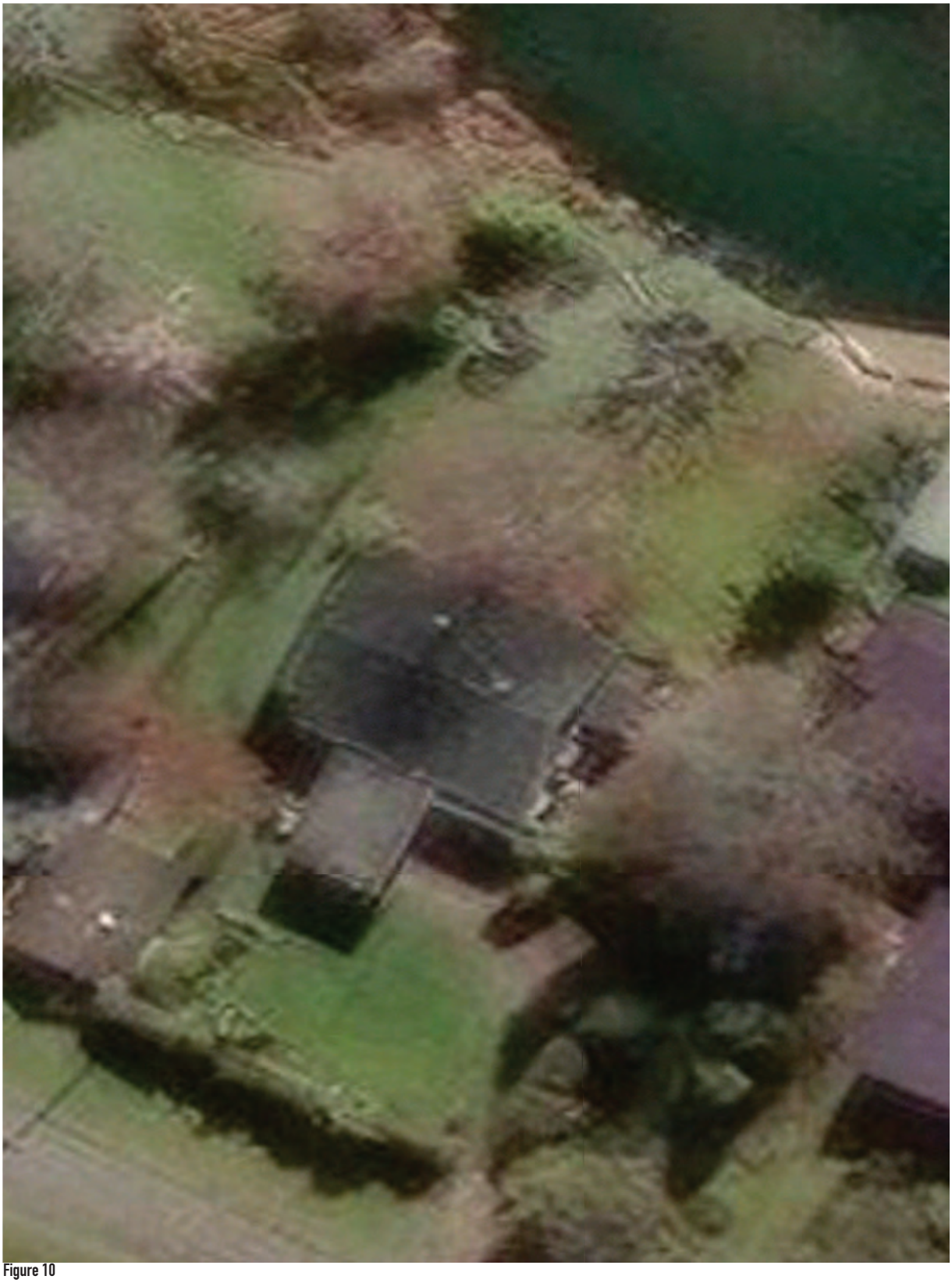


Figure 10
Aerial View: Takinga Street
Note. Image captured from Apple Maps (3D view).

Peeling Away The Layers Takinga Street: Ground Floor, Modern.

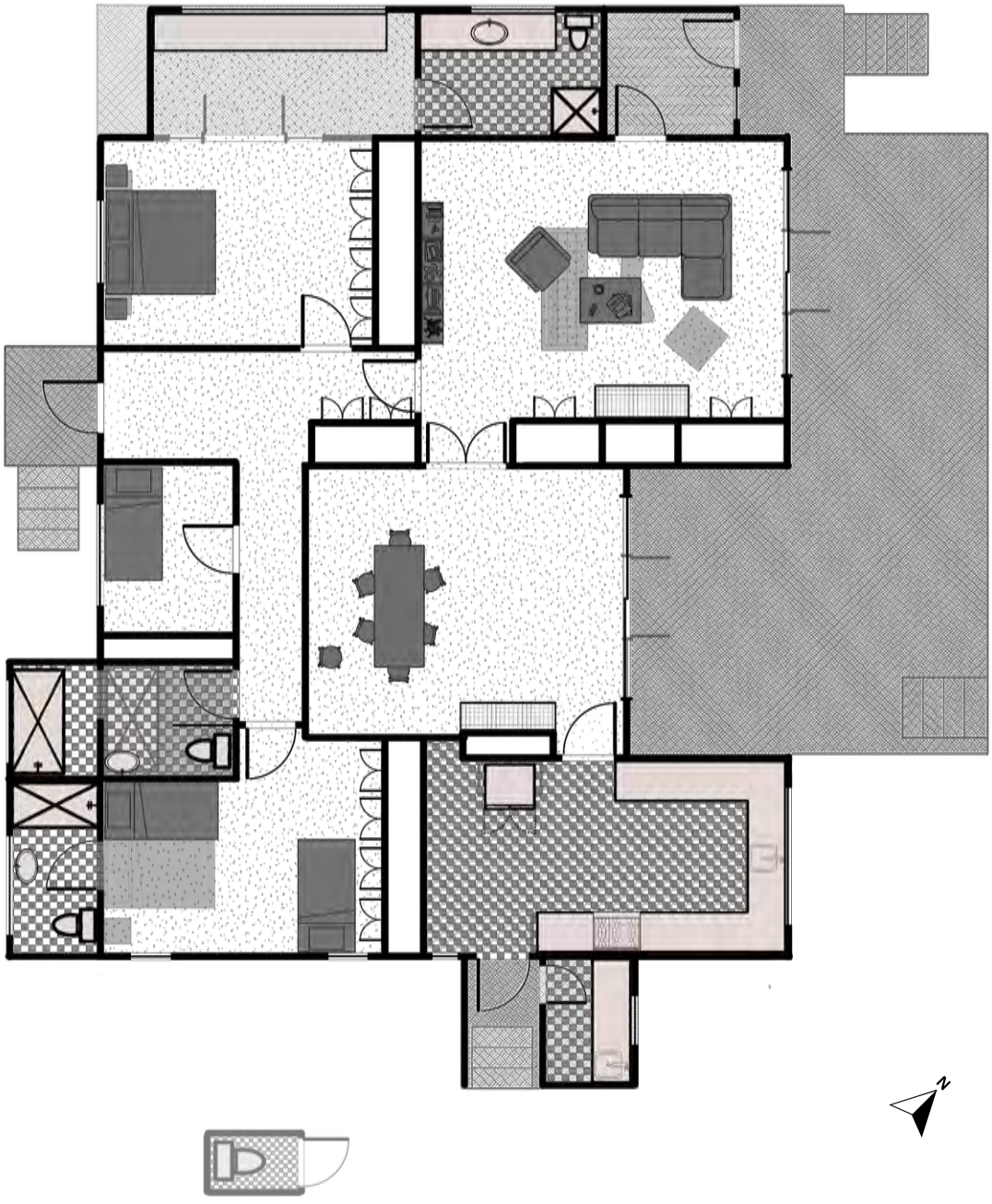


Figure 11
Peeling Away the Layers: Takinga Street. Ground Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Takinga Street: Ground Floor, As Built.

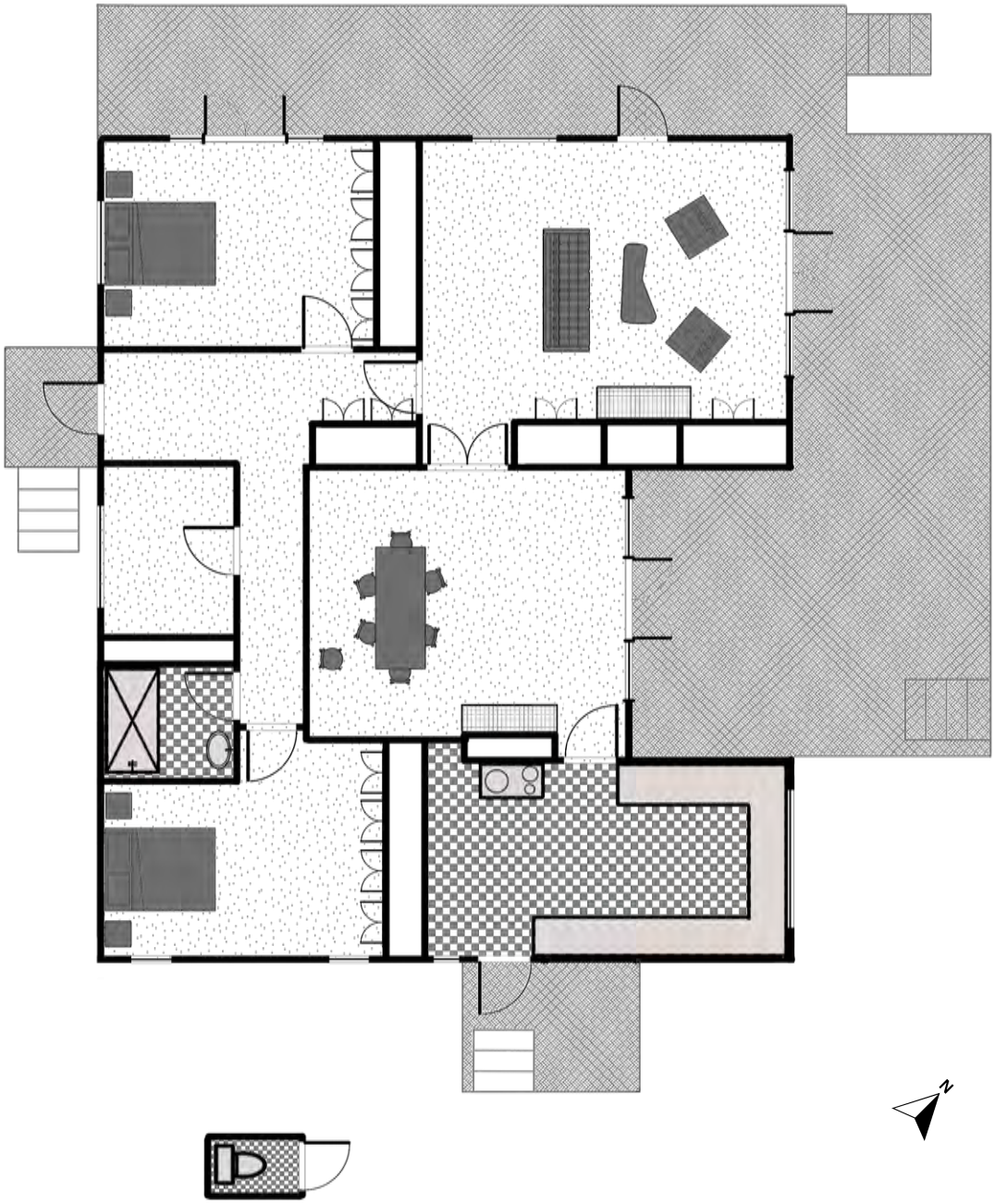


Figure 12
Peeling Away the Layers: Takinga Street. Ground Floor, As Built
Note. Plan drawing and illustration by the author.

Structural diagram, Takinga Street: Ground Floor.

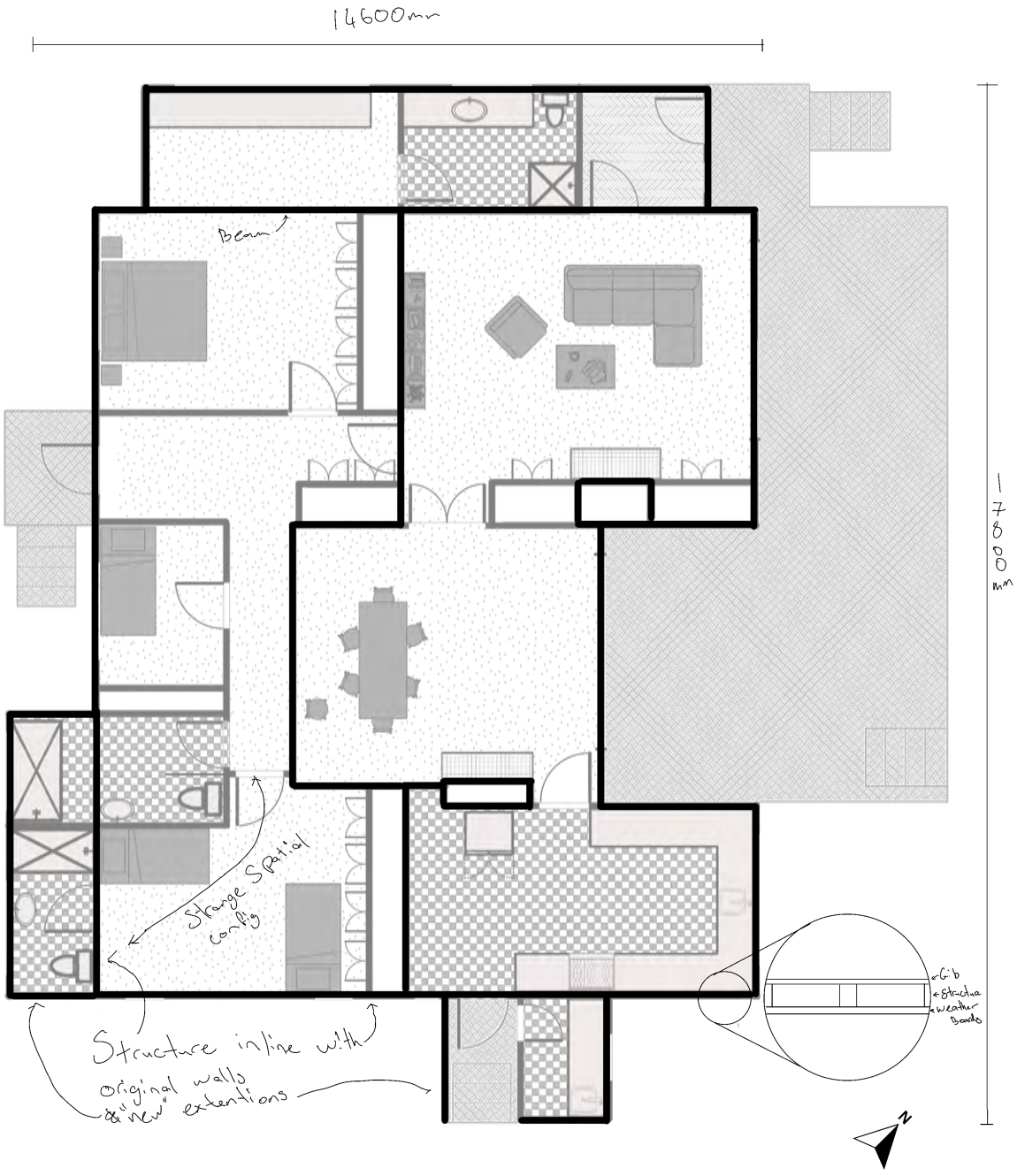


Figure 13
Structural Digram: Takinga Street, Ground Floor,
Note. Plan drawing and illustration by the author.

06.02. Counter Case Studies

The following counter case studies expand on this analysis by exploring houses where longevity is limited instead of promoted. While the main case studies illustrate how repairability and custodianship help preserve buildings over time, these examples highlight situations where construction methods, servicing approaches, or site conditions restrict adaptation and lead to decline or replacement.

Youngs Lane and Wade River Road were chosen for direct comparison with the earlier cases. Both are relatively modern structures that, although they seem traditional, have limited potential for incremental repair. The constraints in these examples are not due to age but stem from complex assemblies, inaccessible systems, and maintenance challenges that surpass practical limits. Consequently, repairs tend to be invasive, expensive, or economically unfeasible.

These counterexamples are not anomalies but reflect wider construction trends. They demonstrate that longevity relies not only on structural durability but also on the interaction between material systems, accessibility, and the ability to maintain the building over time. By presenting these cases alongside the main case studies, the chapter creates a comparative framework that clarifies the factors enabling or limiting long-life housing.

06.02.1. Youngs Lane: Newmarket, Auckland

The Youngs Lane house presents a contrasting model of housing longevity, one shaped by systemic fragility rather than adaptive capacity. Constructed in approximately 1990 as part of the late twentieth-century development boom, the building reflects construction practices associated with the leaky home era. Delivered as a developer-built project, the home embodies a housing logic prioritising short-term optimisation, visual coherence, and market delivery over long-term repairability.

Although a standalone structure, the three-storey townhouse-like configuration introduces complexities more commonly associated with multi-unit housing. The building is timber-framed on a concrete slab, with structural pillars observable at the basement level. While this system appears conventional, the relationship between structure and enclosure is highly integrated. The monolithic rendered cladding forms a continuous external skin that is not readily separable from the underlying assembly. As a result, meaningful alteration or intervention would require extensive disruption to the building fabric.

This integrated construction strategy significantly constrains repair. The home does not anticipate incremental intervention; rather, it resists modification. Junctions are largely sealed, façade systems are monolithic, and failures tend to propagate across assemblies rather than remaining localised. While internal

linings can be removed through standard methods, access to critical systems is limited by the broader construction logic.

The servicing strategy further reinforces this condition. Services are concentrated in a core within a load-bearing wall, with plumbing systems embedded in the slab. This arrangement severely limits accessibility. In practical terms, plumbing and electrical systems cannot be meaningfully altered or repaired without demolition. Wet areas are fixed, spatially constrained, and functionally inadequate, illustrating how servicing decisions shape the home's long-term adaptability.

Evidence of modification within the building is limited. Although the house has undergone a basement extension and minor internal reconfiguration, interventions have remained largely cosmetic. The scope for further adaptation appears constrained by cost, technical complexity, and material fragility. The rendered plaster cladding, now brittle with age, complicates even modest alterations. For example, the insertion of double-glazed windows would require substantial reconstruction of the cladding. The building thus exhibits a condition of stasis rather than an evolving architectural biography. Repair and maintenance within the home are disproportionately invasive. Replacement of cladding, membranes, or waterproofing systems is economically prohibitive. Failures are not isolated but systemic, characteristic of leaky home construction. Repair typically requires specialist trades, full system replacement, and extensive material removal. In this context, repair becomes structurally possible yet economically irrational. This condition is further intensified by the vertical configuration of the home, where the three-storey height increases both complexity and cost of intervention.

Material behaviour further contributes to this dynamic. The monolithic plaster cladding system, supported by proprietary and composite assemblies, is prone to rapid deterioration and hidden failure. Unlike traditional cladding systems, such as timber weatherboards, which rely on mechanical weather-shedding principles, the rendered envelope relies primarily on waterproofing. Protection is achieved through continuous surface integrity rather than through layered drainage and ventilation, which means that minor defects can produce systemic consequences. This condition is exacerbated by the absence of eaves, which would otherwise provide passive weather protection and reduce direct moisture exposure. Traditional cladding systems also permit localised repair; plaster cladding typically requires intervention at a much larger scale. Even minor failures often necessitate extensive removal, re-rendering, and refinishing in order to maintain envelope continuity. Repair becomes disproportionately invasive, reinforcing the building's resistance to incremental maintenance. While the home has benefited from sustained owner occupation and ongoing repairs, patterns of deterioration remain embedded within the construction system itself

Despite these limitations, the home is not perceived by its occupants as deficient. It remains a sunny, well-loved family home that has undergone periodic updates and repairs. However, this experiential quality exists

in tension with the building's structural reality. The house performs as a home yet resists long-term preservation. Thermal performance presents an additional point of friction. The building suffers from poor environmental regulation, particularly overheating during the summer months. Addressing these issues would require interventions constrained by the broader assembly logic, further reinforcing the building's limited adaptive capacity.

Economic considerations ultimately dominate the home's projected lifespan. The cost of comprehensive remediation, particularly recladding, is likely to exceed the economic value of repair. Demolition and reconstruction are the more rational pathways. This condition is exacerbated by the site's high land value in Newmarket, where depreciation logic privileges land over buildings. The Youngs Lane home thus exemplifies a form of architectural disposability. The building resists repair and modification, thereby encouraging eventual replacement. Longevity is constrained not by catastrophic structural failure, but by the cumulative interaction of inaccessible systems, brittle materials, systemic defects, and economic calculation.

Experientially, the building does not age gracefully. Wear signals a defect rather than a character, while repair is experienced as burdensome and technical rather than natural. The home exists in a state of temporal compression, in which functional lifespan is significantly shorter than theoretical structural durability. Ultimately, Young's Lane reads as a replacement-oriented commodity rather than a repairable structure. Its construction system, servicing strategy, and material behaviour collectively undermine long-term adaptability. In contrast to earlier case studies, where longevity emerged through incremental repair and modification, this home illustrates how contemporary construction logics can actively produce obsolescence. Durability here is defined not by the capacity to accommodate change, but by the inevitability of replacement.

Youngs Lane:
Aerial View.

Figure 14
Aerial View: Youngs Lane
Note. Image captured from Apple Maps (3D view).

Peeling Away The Layers Youngs Lane: Ground Floor, Modern.

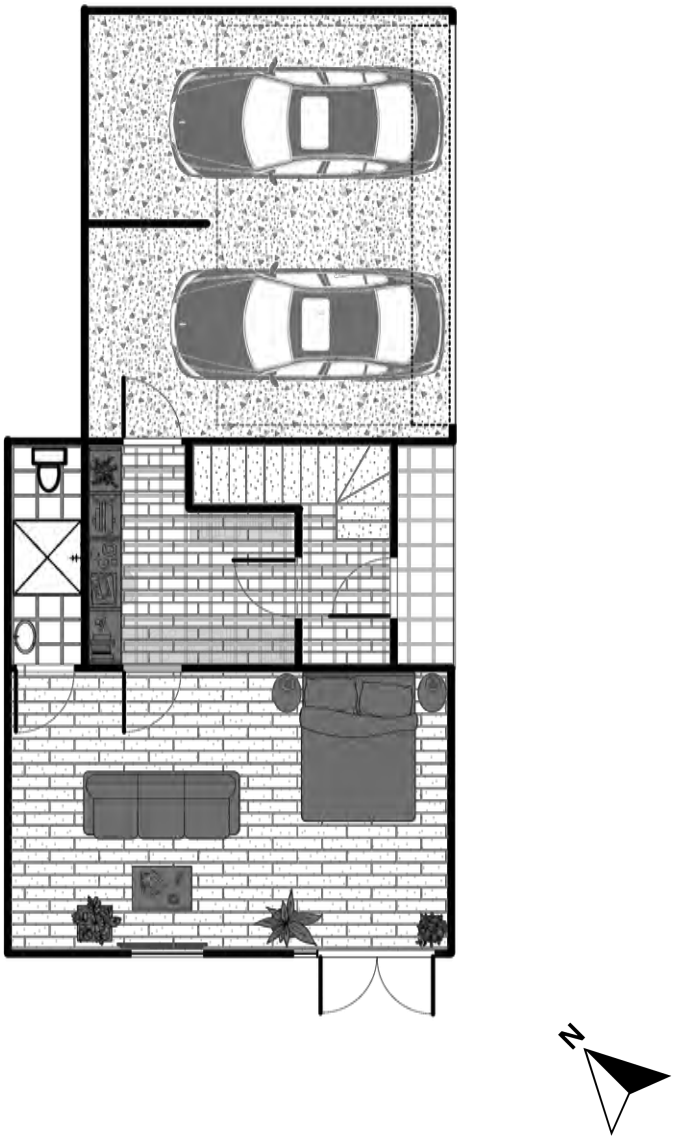


Figure 15
Peeling Away the Layers: Youngs Lane. Ground Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: Ground Floor, Past.

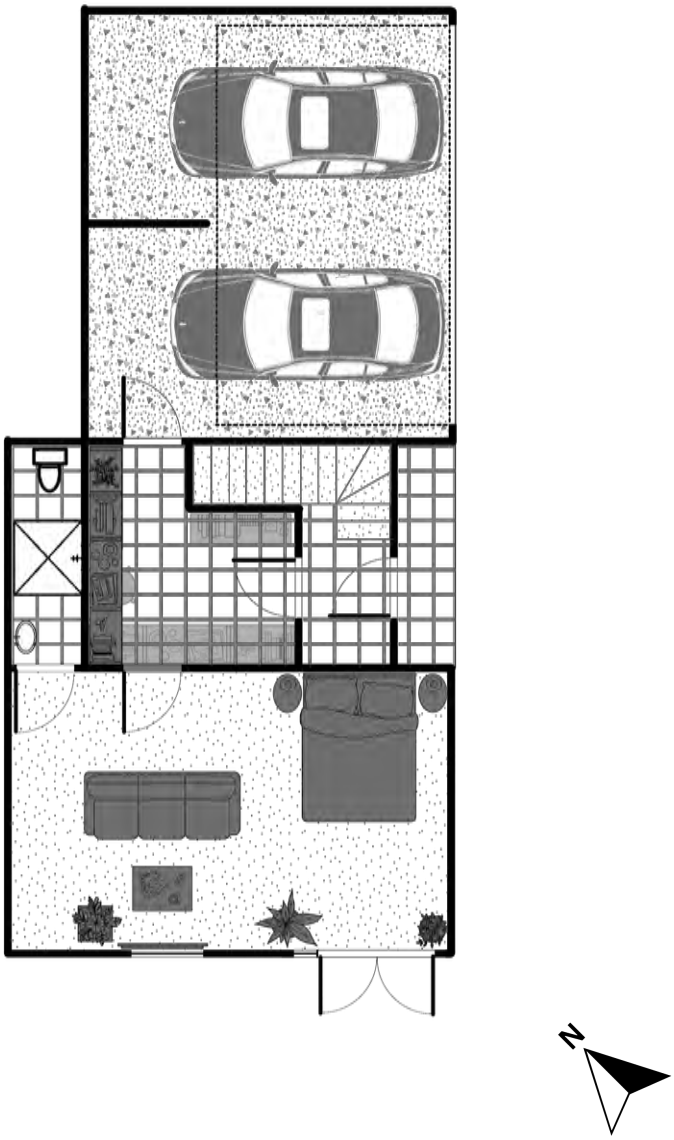


Figure 16
Peeling Away the Layers: Youngs Lane. Ground Floor, Past
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: Ground Floor, As Built.

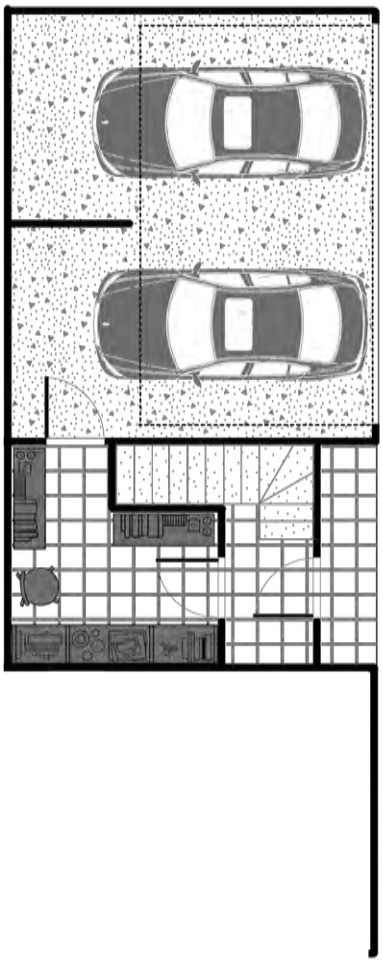


Figure 17
Peeling Away the Layers: Youngs Lane. Ground Floor, As Built
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane:
First Floor, Modern.

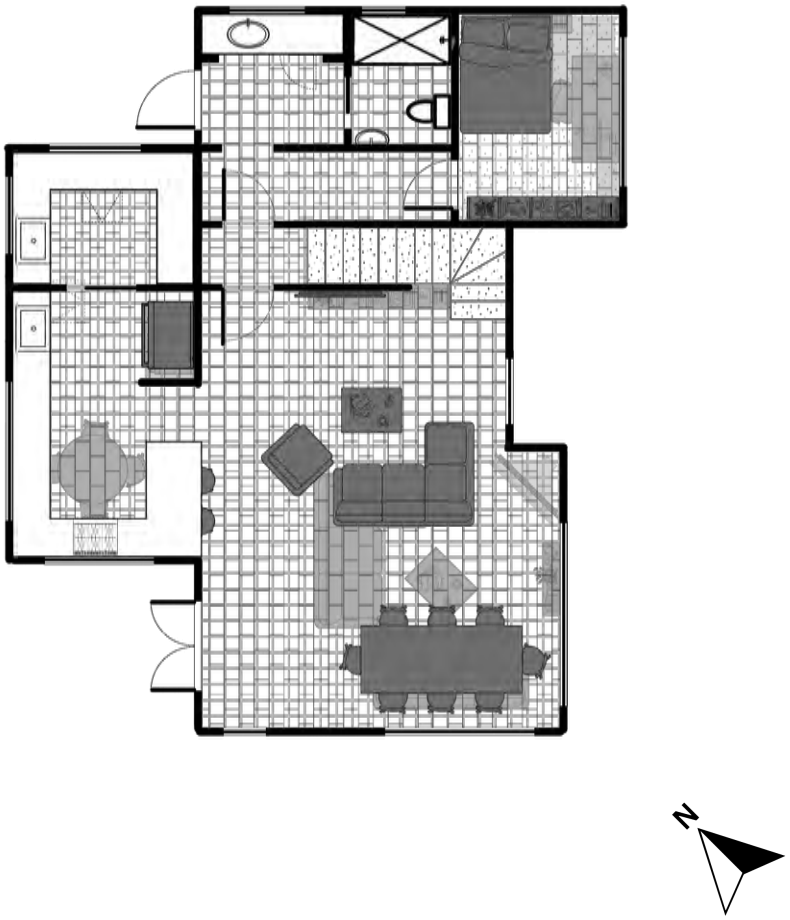


Figure 18
Peeling Away the Layers: Youngs Lane. First Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: First Floor, Past.

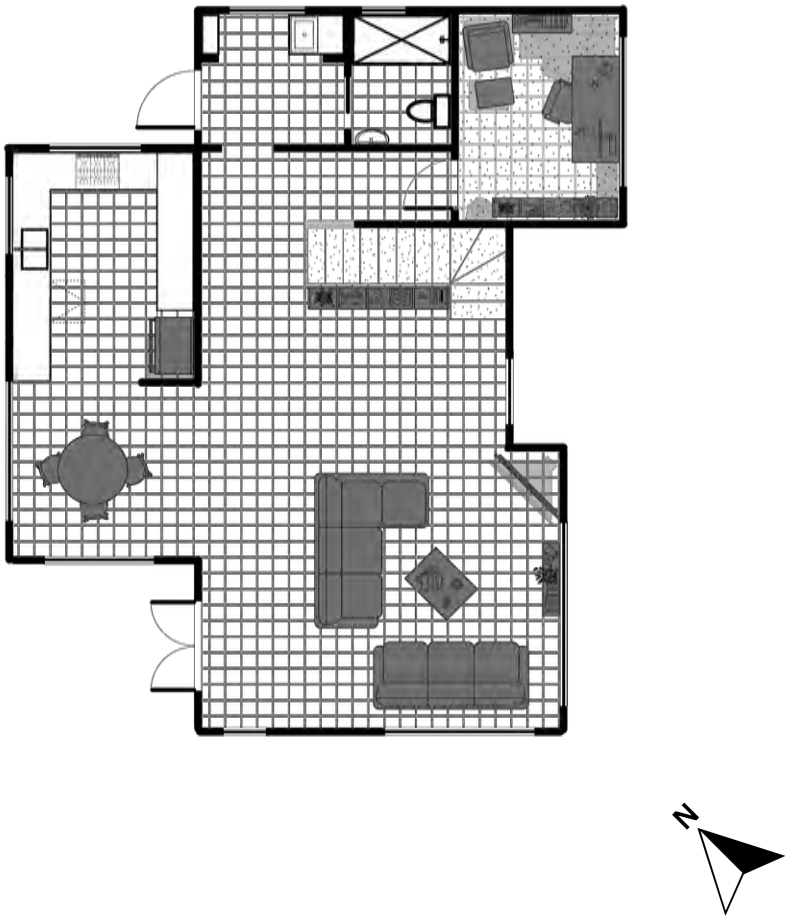


Figure 19
Peeling Away the Layers: Youngs Lane. First Floor, Past
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: First Floor, As Built.

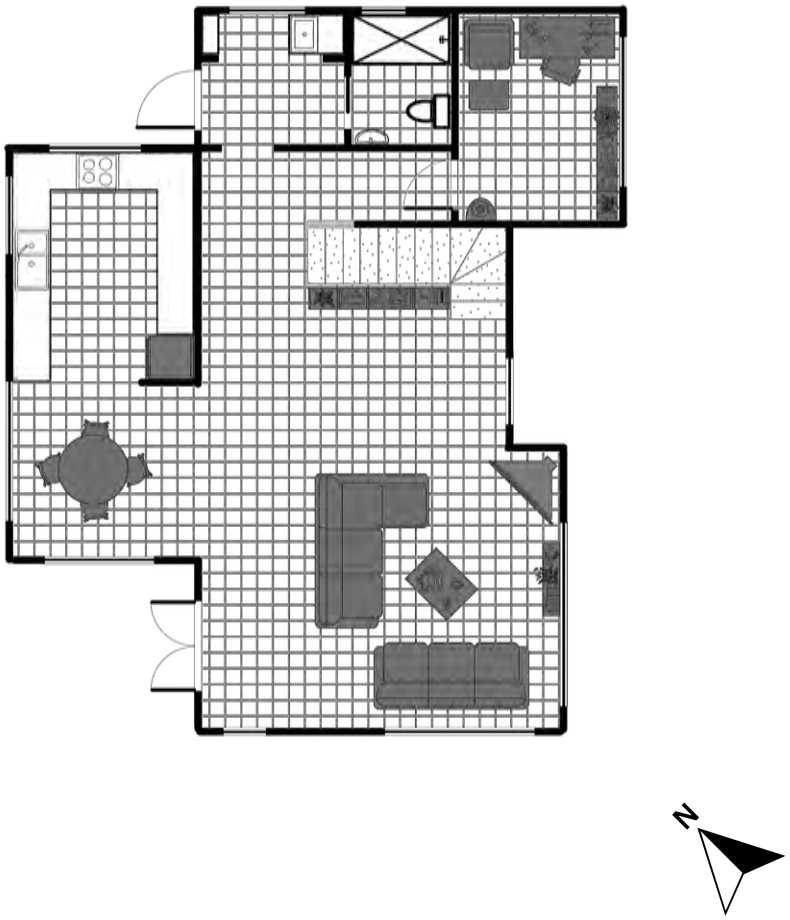


Figure 20
Peeling Away the Layers: Youngs Lane. First Floor, As Built
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: Second Floor, Modern.

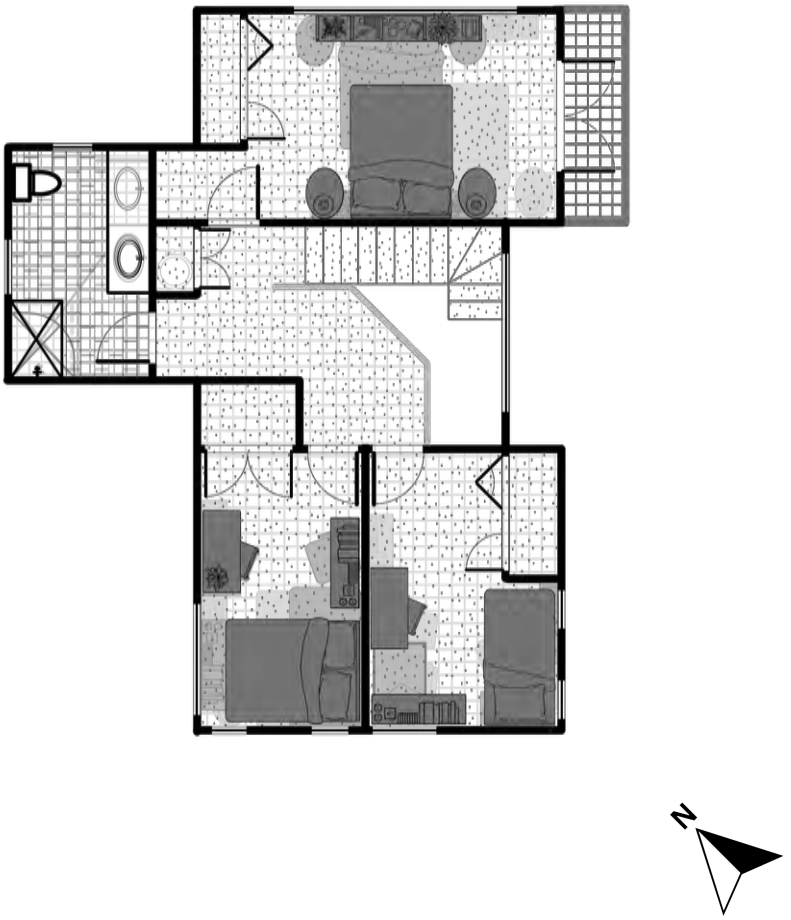


Figure 21
Peeling Away the Layers: Youngs Lane. Second Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: Second Floor, Past.

Figure 22
Peeling Away the Layers: Youngs Lane. Second Floor, Past
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Youngs Lane: Second Floor, As Built.

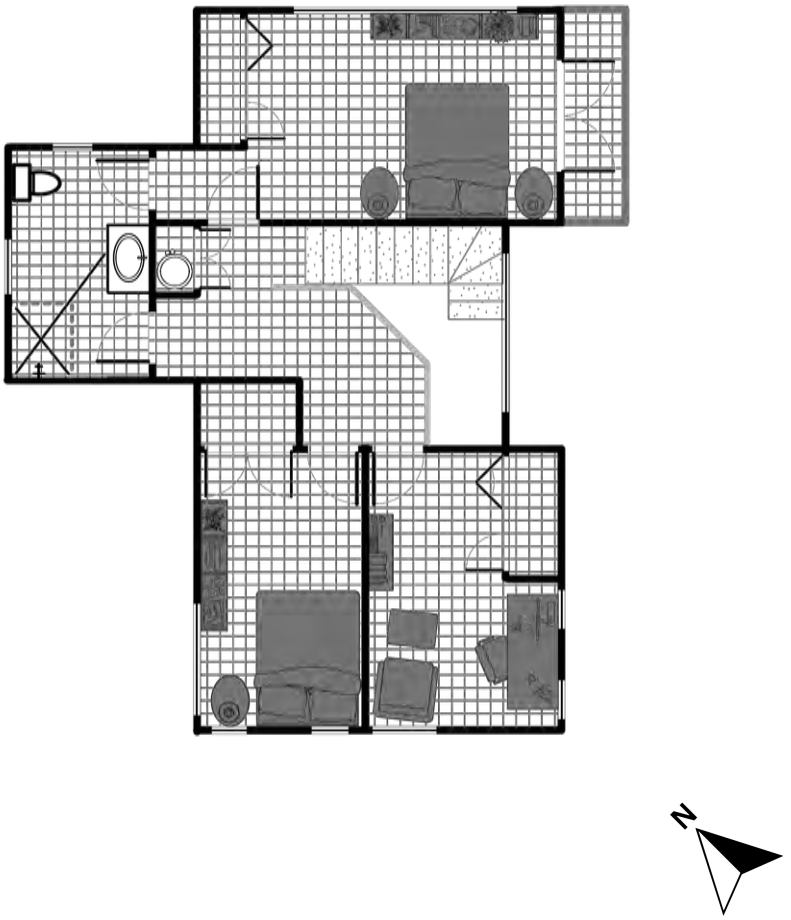


Figure 23
Peeling Away the Layers: Youngs Lane. Second Floor, As Built
Note. Plan drawing and illustration by the author.

Structural diagram, Youngs Lane: Ground Floor.

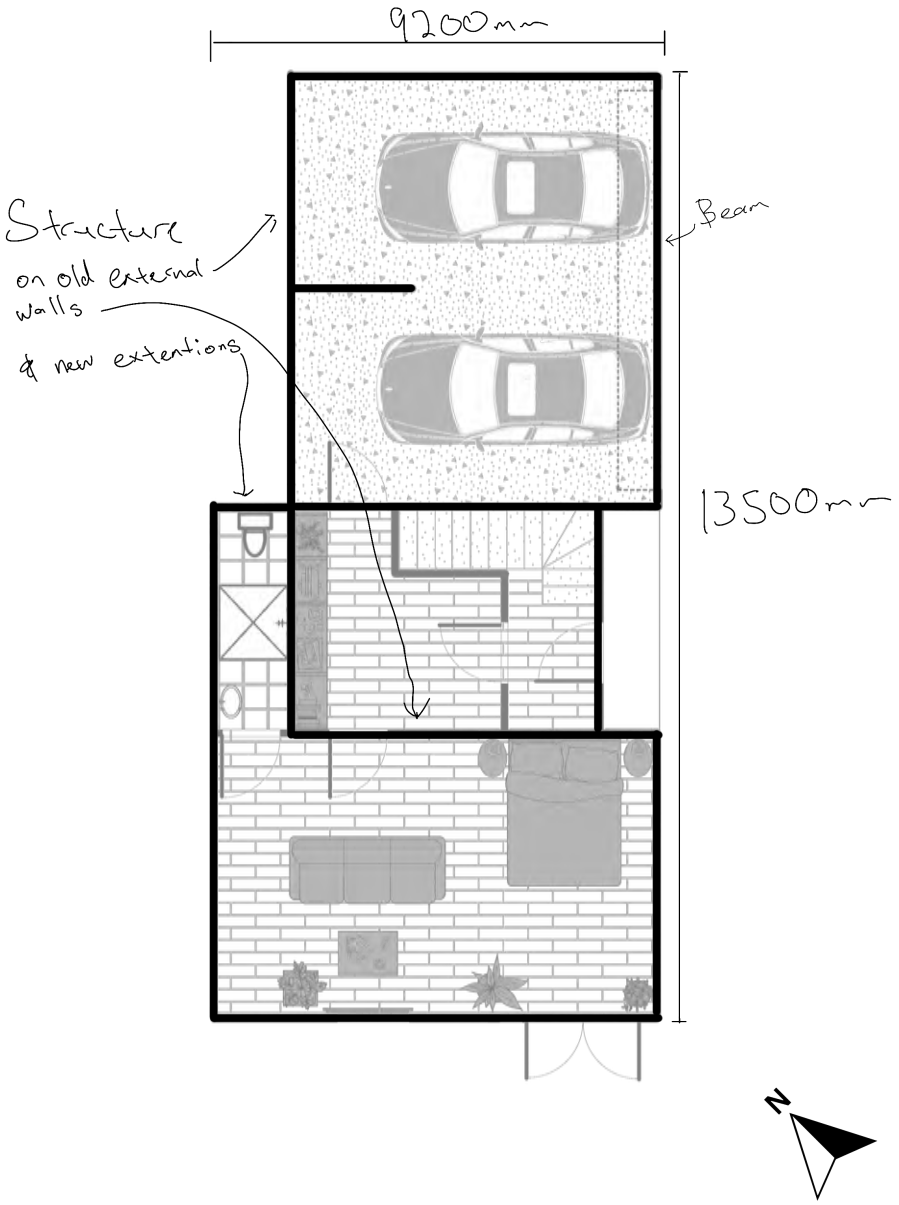


Figure 24
Structural Digram: Youngs Lane. Ground Floor,
Note. Plan drawing and illustration by the author.

Structural diagram, Youngs Lane:
First Floor.

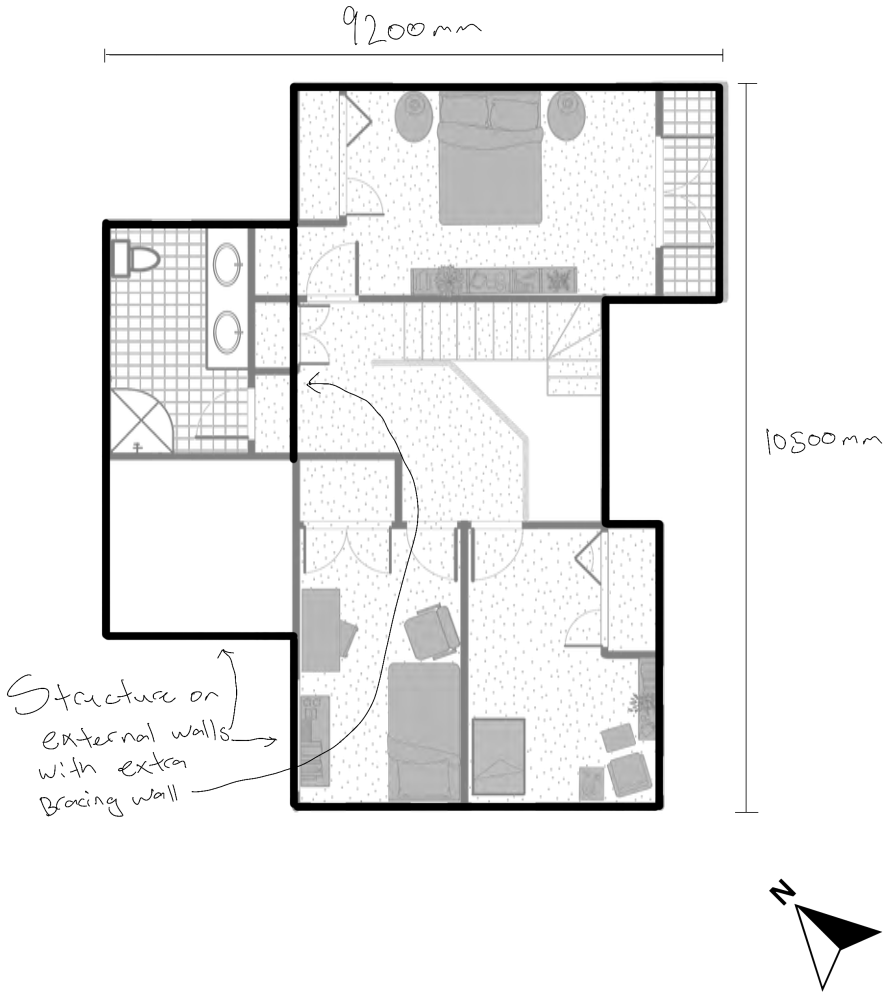


Figure 25
Structural Digram: Youngs Lane. First Floor,
Note. Plan drawing and illustration by the author.

Structural diagram, Youngs Lane: Second Floor.

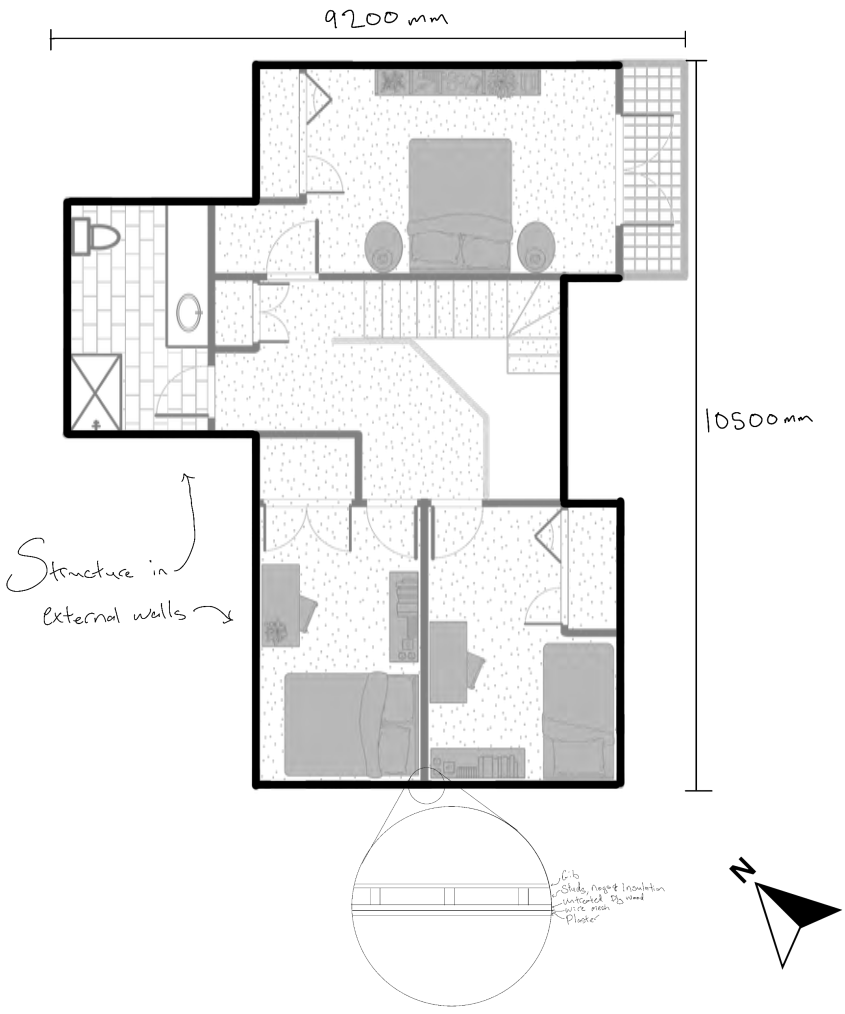


Figure 26
Structural Digram: Youngs Lane. Second Floor,
Note. Plan drawing and illustration by the author.

06.02.2. Wade River Road: Whangaparaoa, Auckland

The Wade River Road house exemplifies a form of housing longevity defined by situational constraints rather than systemic defects. Constructed in the late 1990s as a developer-built project, the home reflects a conventional timber-framed construction system typical of its period. While the building is structurally sound and materially repairable, its long-term viability is shaped by the interaction between site conditions, material choices, and maintenance demands.

The home is a two-storey home with a basement garage, situated on a steeply sloping site. At one end, the main floor aligns directly with ground level, whereas at the opposite end, the structure is elevated approximately twelve metres above the terrain, supported on stilts. This uneven site relationship introduces significant asymmetry in both structural exposure and maintenance accessibility. Although the building's form remains relatively simple, the vertical separation between ground and envelope produces conditions more commonly associated with complex architectural assemblies. The structural system follows standard timber-framed construction. Cedar weatherboards form the primary cladding, supported by conventional framing elements. In principle, the structure and enclosure systems remain separable, allowing interventions to be carried out without destabilising the building. Unlike leaky home construction, failures observed within the home are largely localised rather than systemic. Visible deterioration is present, including material fatigue and isolated instances of rot, yet the building does not exhibit evidence of catastrophic envelope failure.

Despite this technical repairability, maintenance conditions significantly complicate long-term care. Cedar weatherboards, while durable and repairable, constitute a high-maintenance cladding system requiring regular oiling and surface treatment. This requirement becomes problematic when considered in relation to the building's elevation. On the most exposed and sun-affected façade, the cladding is located up to twelve metres above ground level. Access for routine maintenance or repair is therefore logistically complex and economically burdensome. Recladding or comprehensive exterior repair would necessitate extensive scaffolding, with quoted costs exceeding practical thresholds for homeowner investment.

Environmental exposure further intensifies these challenges. The home is subject to wind and significant ultraviolet degradation typical of coastal conditions. While salt air effects appear relatively minor, solar exposure has accelerated visible material deterioration, particularly on elevated façades. The envelope, although functional, requires sustained intervention to prevent progressive decline.

Repair within the home remains technically feasible but increasingly disproportionate. Joinery elements can be replaced from the interior, and services, while largely concealed, can be accessed with minor intrusion. However, the scale and cost of exterior maintenance impose an escalating burden. Repair, rather than

routine maintenance, becomes an event that requires specialist trades, temporary access systems, and a significant financial commitment.

Spatially, the home retains a degree of adaptability. The internal layout could be reconfigured without substantial structural disruption, and rooms are comparatively generous in scale. Limitations to adaptation arise less from spatial rigidity than from the absence of economic or regulatory pressures encouraging transformation. The home's challenges emerge not from inflexibility but from the difficulty of sustaining the building envelope over time. Occupational patterns play a critical role in shaping the home's current condition. Operating primarily as a rental property, the house exhibits signs of deferred maintenance and reduced care cycles. While the structure retains what may be described as "good bones," the cumulative effects of limited investment are increasingly visible. In this context, deterioration reflects not material inadequacy, but the practical consequences of maintenance complexity.

The Wade River Road house is materially durable and structurally repairable, yet its longevity is constrained by the impracticality of maintenance. This condition illustrates how architectural decisions, particularly site response and envelope accessibility, can undermine the long-term viability of technically sound buildings. Ageing is perceived less as character formation and more as an emerging anxiety. Repair is understood as necessary yet burdensome, with maintenance demands appearing continuous rather than episodic. Wade River Road thus appears to be a repairable structure whose lifespan is constrained by maintenance burden. Its construction system supports intervention, yet its elevated site condition renders that intervention increasingly complex. The home ultimately demonstrates that repairability alone does not guarantee longevity. Architectural responses to site, material selection, and maintenance accessibility remain equally decisive. Durability, in this instance, is defined not by resistance to change or failure, but by the sustainability of care.

Wade River Road: Aerial View.

Figure 27
Aerial View: Wade River Road
Note. Image captured from Apple Maps (3D view).

Peeling Away The Layers Wade River Road: Ground Floor, Modern.

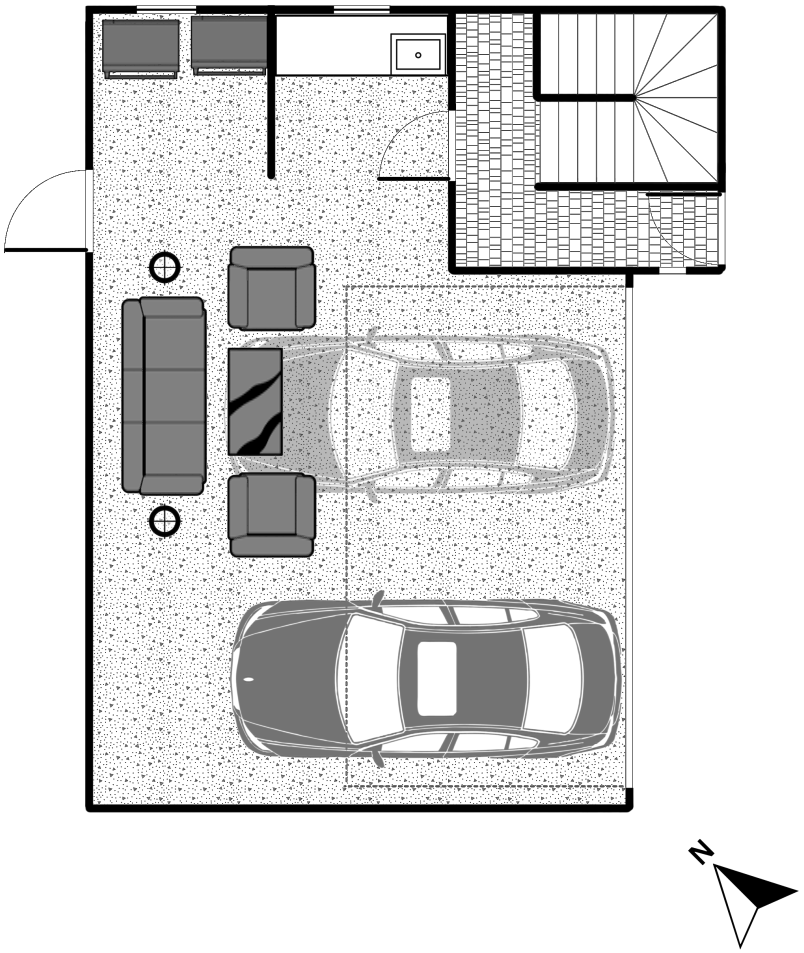


Figure 28
Peeling Away the Layers: Wade River Road. Ground Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Wade River Road: Ground Floor, As Built.

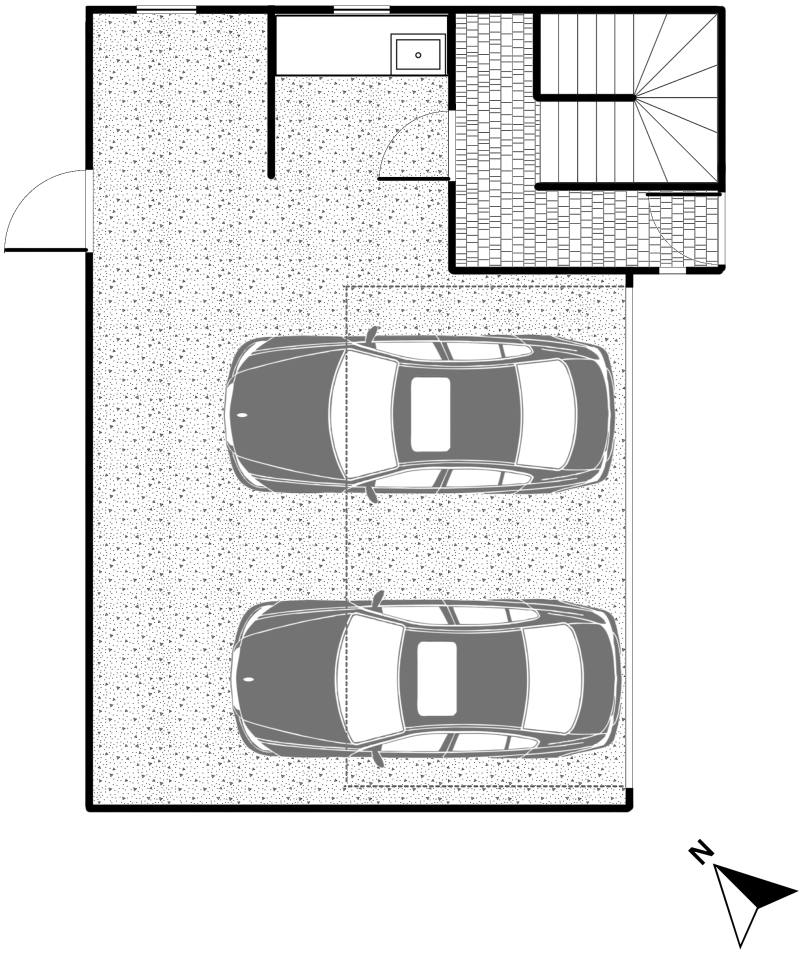


Figure 29
Peeling Away the Layers: Wade River Road. Ground Floor, As Built
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Wade River Road: First Floor, Modern.

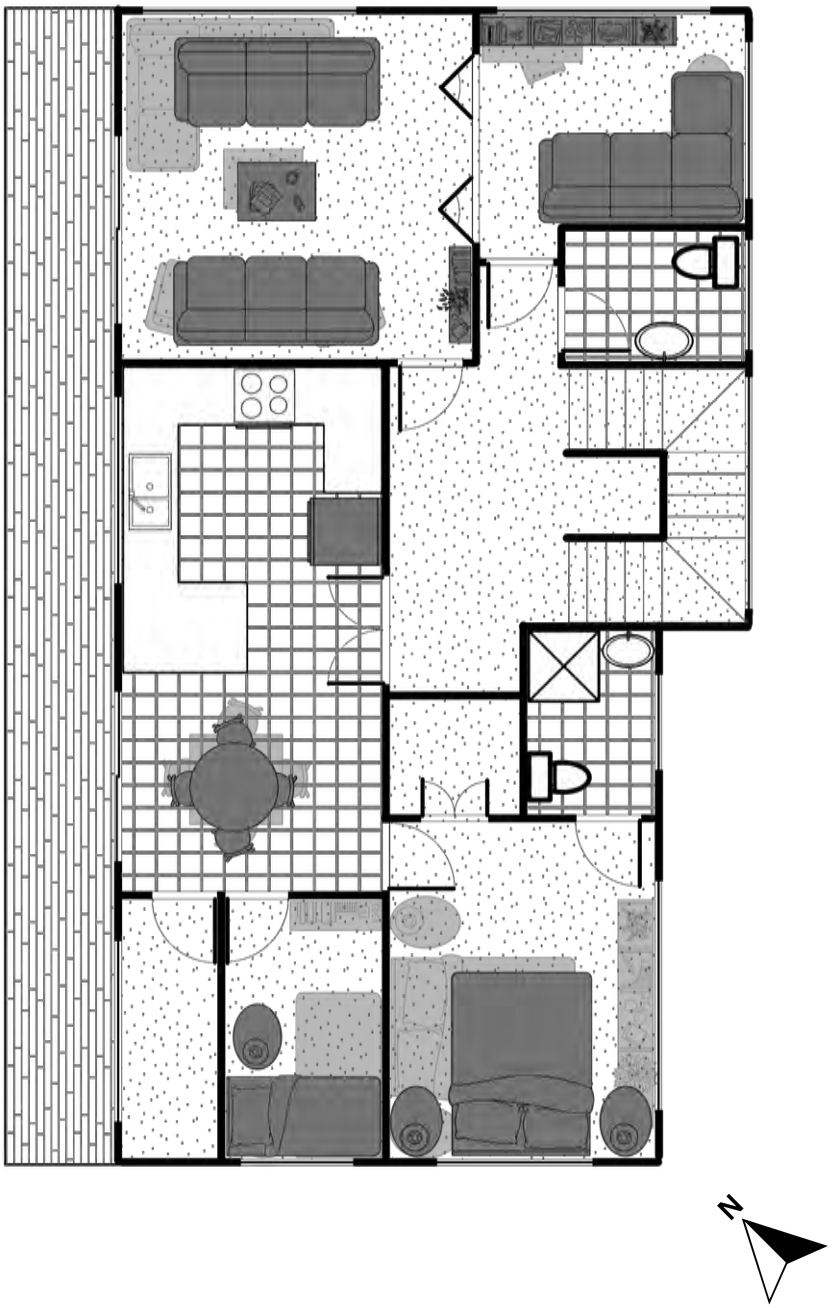


Figure 30
Peeling Away the Layers: Wade River Road. First Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Wade River Road: First Floor, As Built.

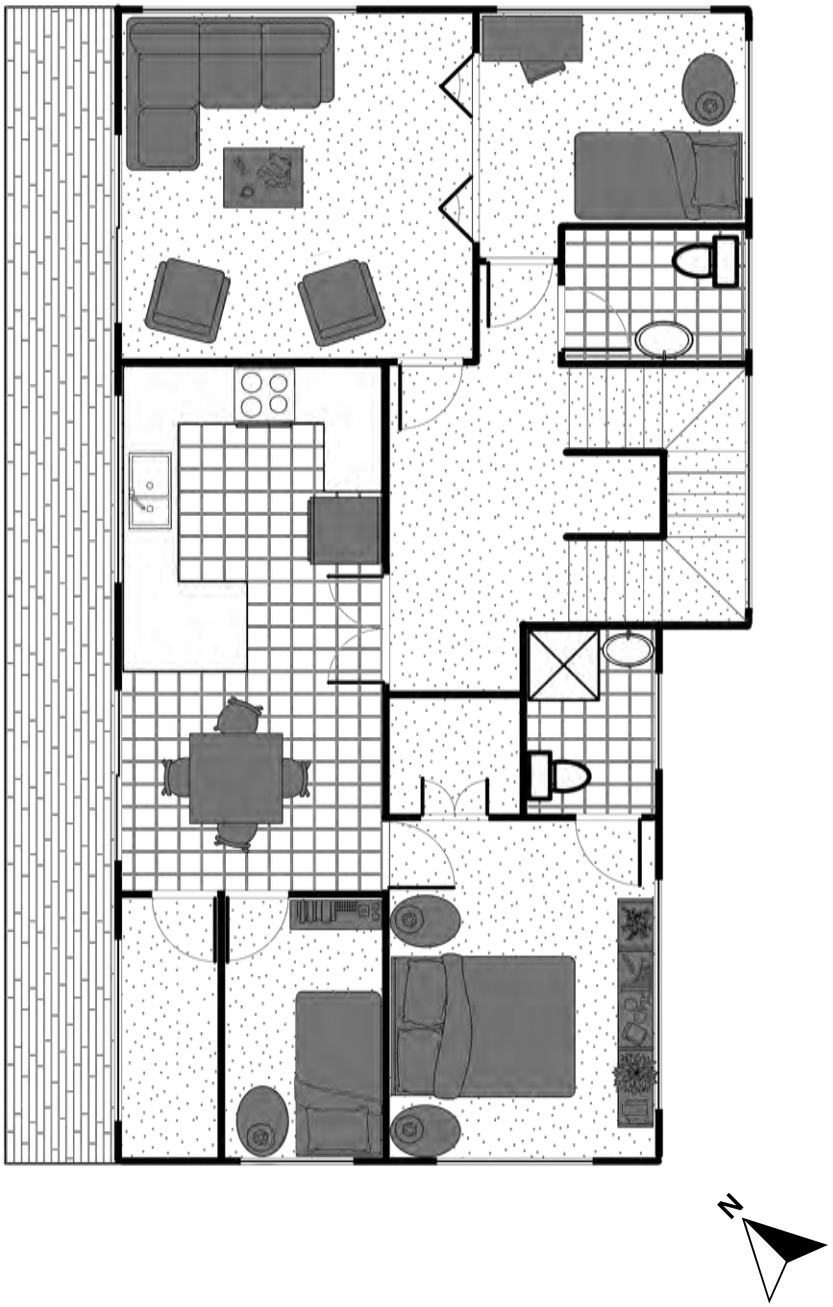


Figure 31
Peeling Away the Layers: Wade River Road. First Floor, As Built
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Wade River Road: Second Floor, Modern.

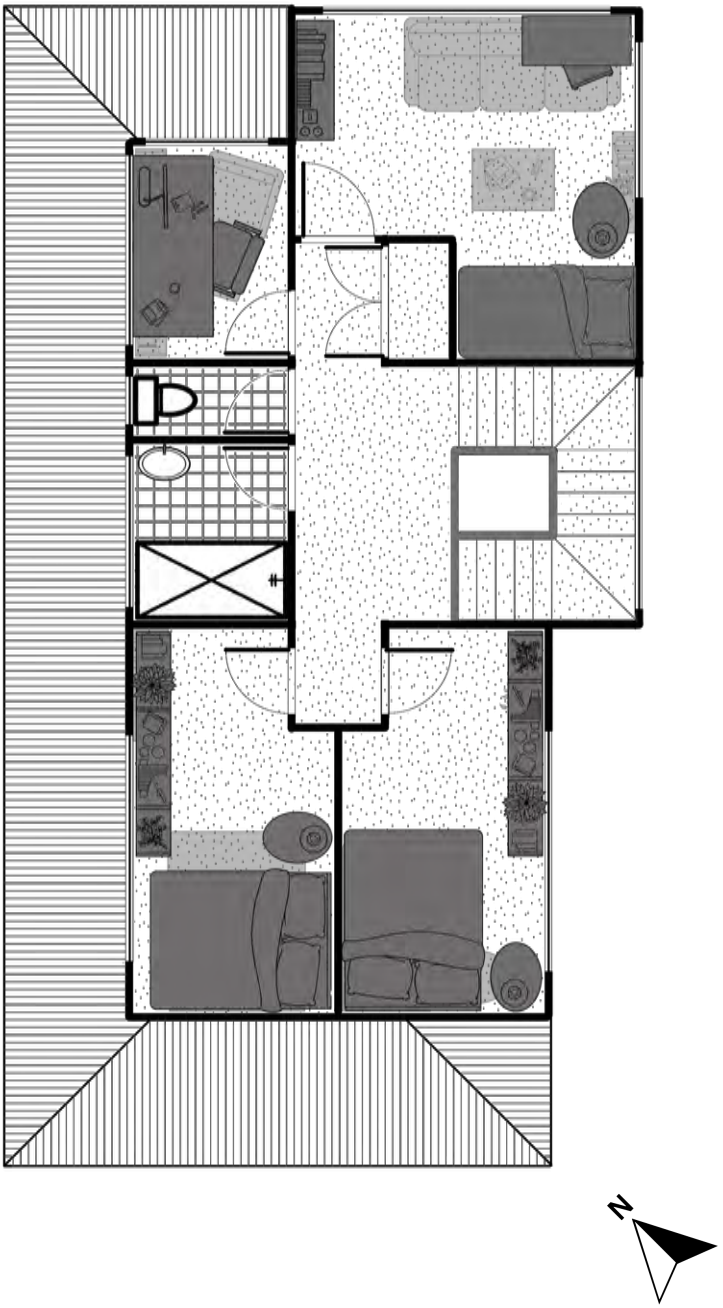


Figure 32
Peeling Away the Layers: Wade River Road. Second Floor, Modern
Note. Plan drawing and illustration by the author.

Peeling Away The Layers Wade River Road: Second Floor, As Built.

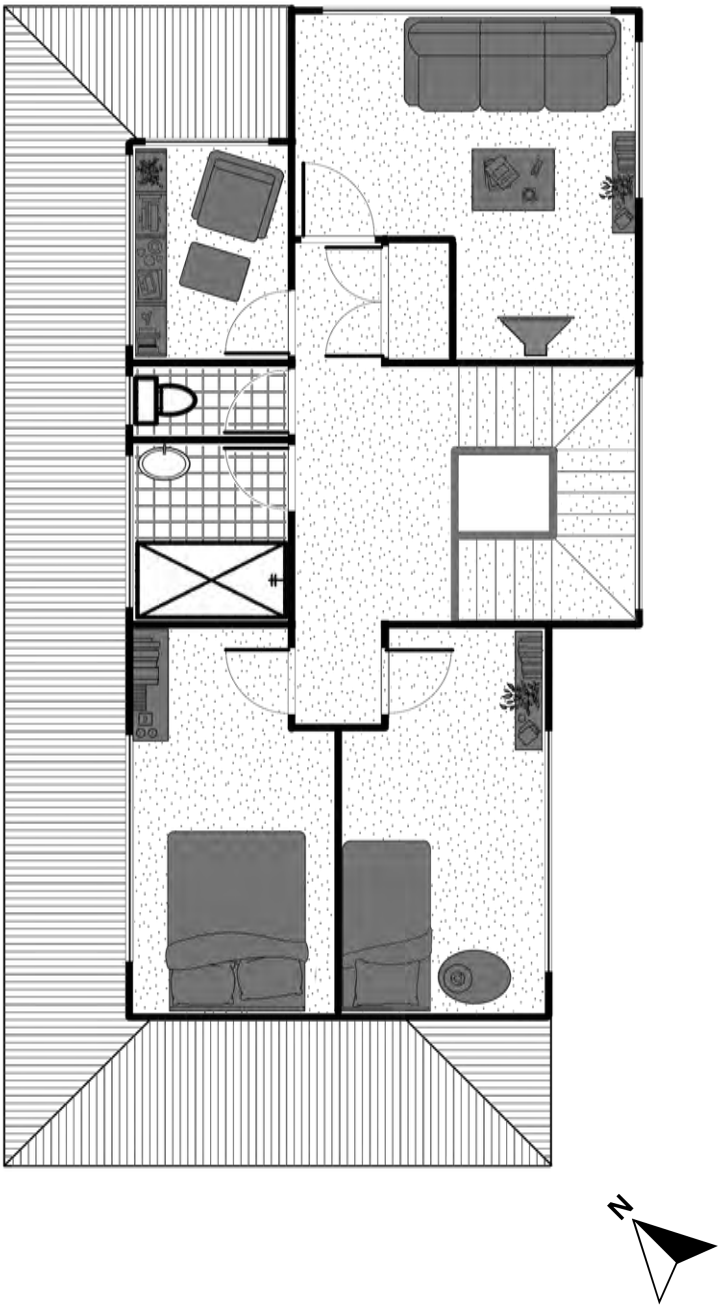


Figure 33
Peeling Away the Layers: Wade River Road. Second Floor, As Built.
Note. Plan drawing and illustration by the author.

Structural diagram, Wade River Road: Ground Floor.

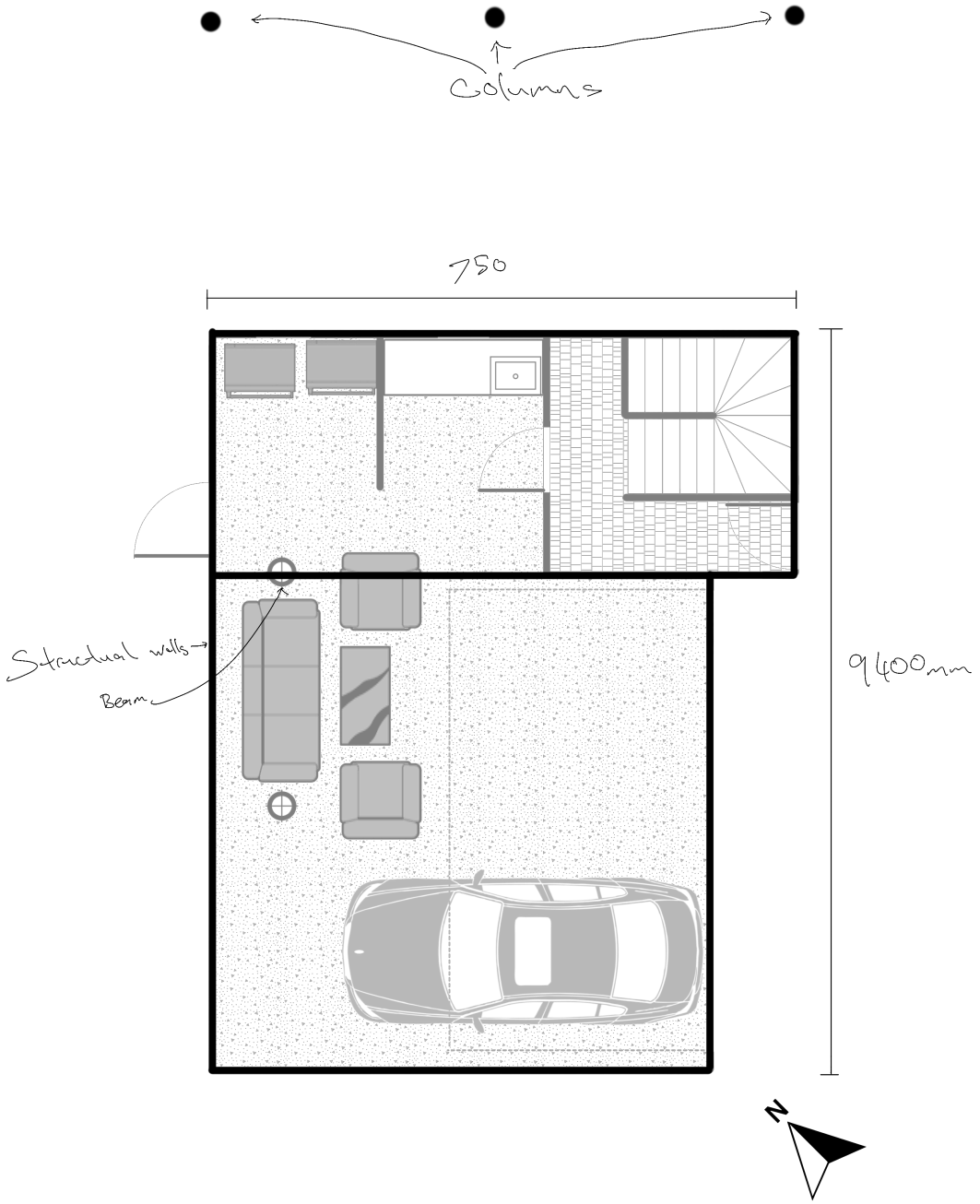


Figure 34
Structural Digram: Wade River Road. Ground Floor,
Note. Plan drawing and illustration by the author.

Structural diagram, Wade River Road: First Floor.

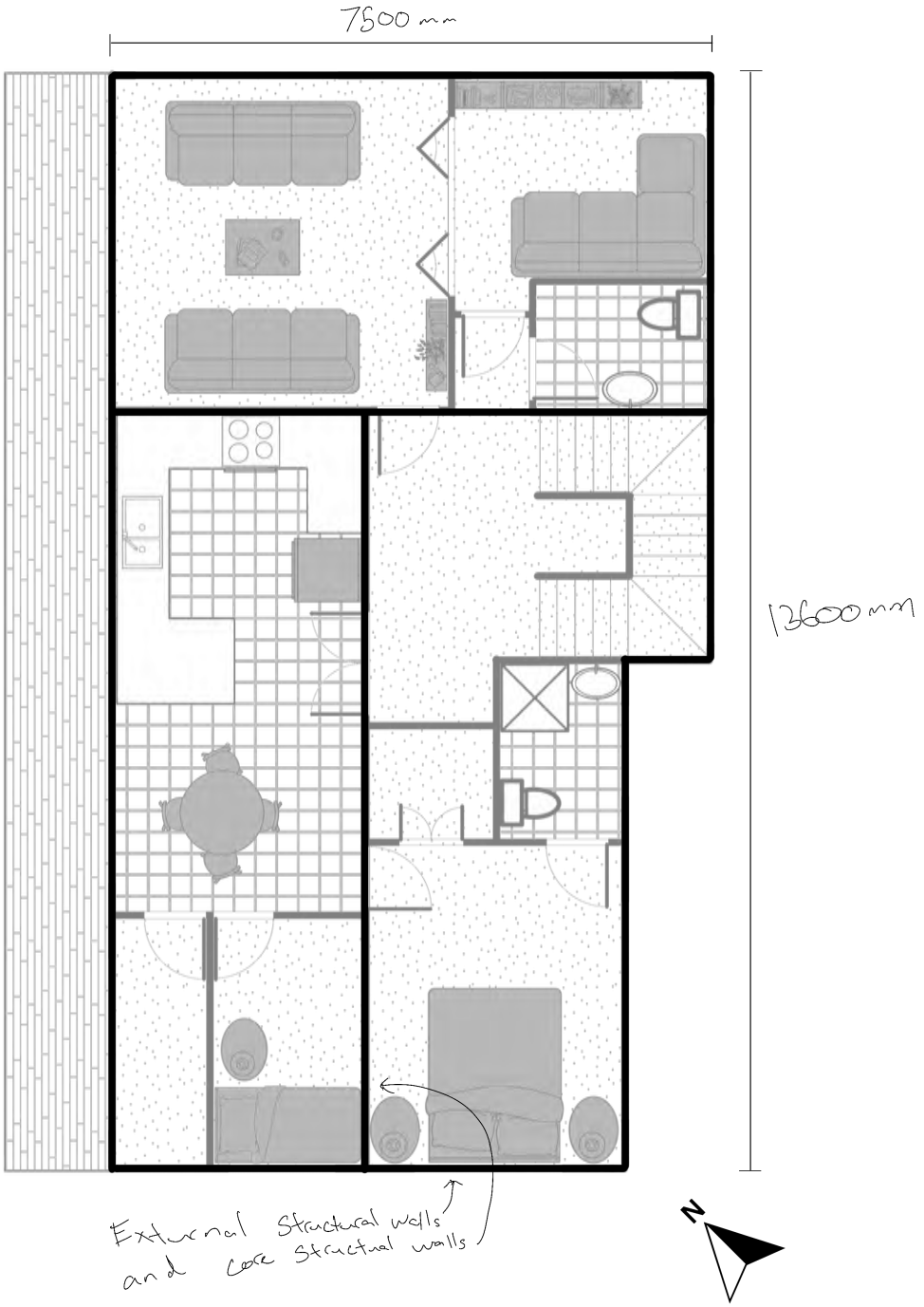


Figure 35
Structural Digram: Wade River Road. First Floor,
Note. Plan drawing and illustration by the author.

Structural diagram, Wade River Road: Second Floor.

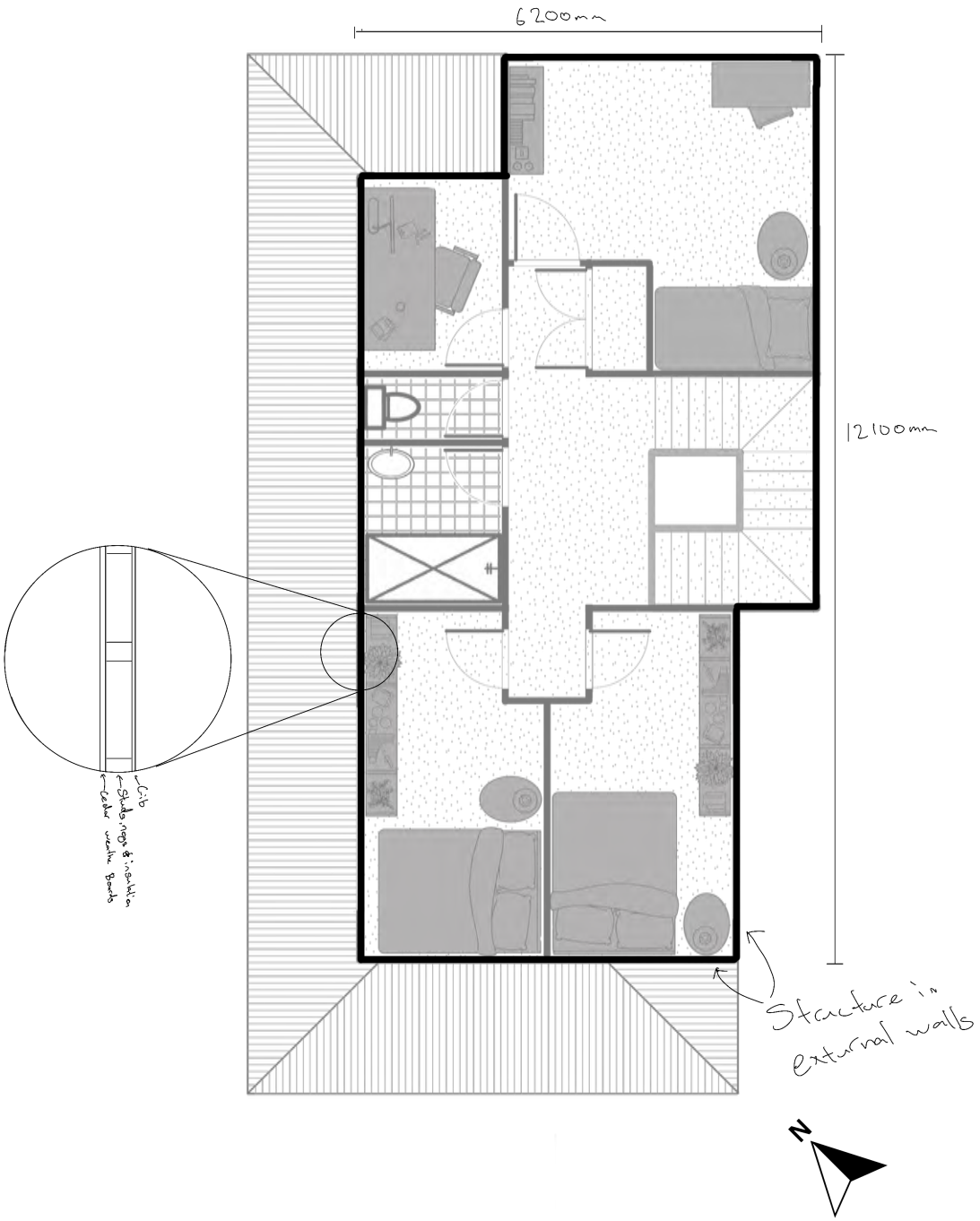


Figure 36
Structural Digram: Wade River Road. First Floor,
Note. Plan drawing and illustration by the author.

Chapter 07: Analysis and Discussion

07.01. Core Themes from Case Studies

The four case studies show that housing longevity is not determined by age, material robustness, or construction era alone. Instead, longevity emerges through the interaction of construction logic, access to systems, patterns of occupation, and the economic and cultural conditions that shape maintenance. Repairability functions as a systemic quality, embedded within architectural assembly and sustained through use.

A central theme across the cases is the importance of system separability. In both Hanson Street and Takinga Street, structural elements remain distinct from enclosure systems and servicing layers. Timber framing supports weatherboard cladding that relies on mechanical weather shedding rather than on sealed-surface continuity. Subfloor crawl spaces and roof cavities allow inspection and intervention without dismantling primary structural components. Internal partitions are lightweight and typically non-load-bearing, enabling spatial reconfiguration without destabilising the envelope. This layered construction logic produces a condition of temporal openness. It allows the building to engage with change without systemic destabilisation, positioning repair as an anticipated condition rather than an exception. The buildings can be entered, modified, and repaired incrementally, and failure is more likely to remain localised than systemic.

Hanson Street illustrates this condition most clearly. Its visible history of extension and re-planning shows that the structure accommodates change without loss of coherence. Additions remain legible and do not undermine the original assembly because the construction system anticipates intervention. Repair and modification become part of the building's biography. Durability here is cumulative, with each intervention extending lifespan rather than compressing it.

Takinga Street presents a related but more complex expression of this logic. The home retains accessible structural and service pathways, yet its history of modification is more compressed. Mid-century additions were visually integrated but did not comprehensively resolve the underlying circulation. As a result, some internal configurations now limit spatial clarity. This indicates that technical repairability does not necessarily produce spatial coherence. Longevity depends not only on access to systems but also on the cumulative quality of spatial evolution.

The counter case studies demonstrate how separability can be diminished or overridden. Youngs Lane shows the consequences of integrated and sealed construction. The monolithic rendered cladding collapses enclosure, waterproofing, and finish into a single system, while slab-embedded plumbing removes service pathways from reach. Structure and servicing are concentrated within load-bearing cores, making

intervention invasive and technically complex. Failure is difficult to isolate, and minor defects can generate disproportionate consequences. Repair shifts from incremental and manageable to comprehensive and expensive.

This contrast highlights the role of legibility. When assemblies are layered and intelligible, occupants and trades can understand how the building is assembled, thereby lowering the threshold for intervention. Where assemblies are concealed within composite systems, the building becomes opaque, and repair is experienced as a specialist undertaking that is risky and disruptive. The home resists adaptation materially and cognitively.

Wade River Road complicates any simple distinction between repairable and non-repairable construction. Its timber framing and weatherboard cladding remain technically separable, and failures tend to be localised rather than systemic. However, the elevated site condition introduces a practical barrier. With exterior cladding located up to twelve metres above ground, routine maintenance requires scaffolding and specialist access. Repair remains possible, yet becomes difficult to sustain as routine care. The case demonstrates that accessibility is not only systemic but also spatial, and that even well-layered construction can be undermined by maintenance conditions created through site response.

A further theme concerns the economic rationality of repair. Hanson Street and Takinga Street operate within contexts where incremental maintenance remains financially manageable. Roofing replacement, insulation upgrades, and selective fabric repair can be undertaken without crossing prohibitive cost thresholds, aligning repair decisions with domestic intention. In Youngs Lane, the economic logic shifts. In a high-value urban context, land appreciation can eclipse building value, and comprehensive remediation, particularly recladding, may exceed the perceived worth of repair. Even when intervention is technically feasible, economic conditions can make replacement the more rational pathway. Wade River Road registers a subtler version of this tension. The building is structurally sound, yet the cost of sustaining elevated cladding systems increases over time, shifting maintenance from routine work to episodic projects that are easier to defer.

Across the cases, occupation and custodianship shape whether repairable potential is realised. Hanson Street suggests that long-term owner-occupation supports cumulative adaptation, with alterations driven by continued habitation rather than by short-term resale. Takinga Street indicates how this relationship can weaken as occupation shifts to rental tenure. Maintenance cycles often slow, and deterioration becomes visible, even when the underlying structure remains capable of renewal. Youngs Lane demonstrates that even committed owners confront limits when construction systems resist access. Wade River Road similarly demonstrates that rental patterns and high access costs contribute to deferred care, producing deterioration associated with practical difficulties rather than systemic collapse.

Together, the case studies suggest three broad conditions for longevity. The first is cumulative adaptability, where layered systems and sustained care reinforce one another over time. The second is latent repairability, where technical capacity persists but is constrained by interrupted care cycles or unresolved spatial organisation. The third is compressed lifespan, where integrated systems, economic pressures, and maintenance complexity discourage long-term preservation.

Overall, the case studies support the argument that longevity is actively produced. It emerges from architectural decisions that anticipate intervention, from economic contexts that keep repair within reach, and from occupation patterns that sustain maintenance. Where separability, legibility, and manageable access align, long-term continuity becomes structurally possible. Where these conditions fragment, lifespan contracts.

07.02. Barriers to Repair in Modern Construction

The counter case studies show that limitations to housing longevity in contemporary New Zealand construction rarely arise from catastrophic structural weakness alone. Instead, they emerge from design and delivery decisions that constrain access, concentrate risk, and privilege short-term optimisation over long-term adaptability. These barriers are technical, economic, regulatory, and cultural, and they operate in combination.

A primary barrier is systemic integration. Contemporary construction often collapses structure, enclosure, waterproofing, and finish into composite assemblies that function as continuous surfaces rather than layered systems. Protection relies on surface integrity rather than redundancy and drainage. When failure occurs, it can propagate across the assembly rather than remaining localised.

Youngs Lane illustrates this condition, its rendered plaster cladding forms a continuous external skin that is not readily separable from the structure. Repair requires dismantling large areas to maintain technical and visual continuity. Intervention becomes invasive and expensive rather than incremental. This integrated logic extends to servicing, where slab-embedded plumbing and load-bearing service cores reduce access pathways and limit spatial reconfiguration. The building resists adaptation because its systems are not spatially independent.

A second barrier arises from the regulatory environment shaped by the leaky homes crisis. In response to widespread moisture failure during the 1990s and early 2000s, compliance regimes intensified their focus on waterproofing performance and liability mitigation. Sealed-envelope integrity and prescriptive detailing became central concerns. While these measures seek to reduce risk, they can also reinforce rigidity. Alterations introduce compliance uncertainty, and modifications to cladding or penetrations may trigger consent requirements or raise warranty concerns.

This context encourages reliance on proprietary systems that offer predictable compliance pathways. Risk avoidance at the point of construction can therefore produce long-term inflexibility. Buildings are optimised for certification and liability control rather than for future intervention.

Economic calculation forms a third barrier. In high-value urban contexts such as Newmarket, land appreciation frequently outpaces the value of buildings. When remediation costs approach redevelopment returns, demolition becomes financially rational. Integrated systems amplify this dynamic by increasing the scale and cost of intervention. Lifespan is shortened not by immediate structural failure but by cost thresholds that make repair disproportionate.

Maintenance complexity presents a fourth barrier. Wade River Road demonstrates how technically repairable systems can become burdensome when site response complicates access. Elevated façades requiring scaffolding transform routine maintenance into substantial projects. While cedar weatherboards are individually replaceable, their height and exposure shift upkeep from a manageable cycle to an episodic undertaking. A distinction emerges between technical repairability and practical accessibility. When maintenance becomes logistically difficult or financially onerous, it is often deferred, accelerating deterioration.

Cultural perception reinforces these technical and economic pressures. Contemporary housing is frequently marketed as a finished product defined by seamless surfaces and visual coherence. Visible patching or incremental modification may be interpreted as imperfection rather than evidence of longevity. Monolithic construction aligns with this aesthetic preference, while layered assemblies that accommodate change appear less resolved. Repair becomes both visually disruptive and technically complex.

Labour and liability structures further mediate access to repair. Composite assemblies and proprietary cladding systems require specialist trades and formal oversight. Insurance and professional indemnity concerns can discourage preventative alteration, raising the threshold for intervention. Minor issues are postponed until they necessitate major work. Time itself operates as a barrier. Developer-led construction models prioritise speed of assembly and market delivery. Long-term maintenance scenarios are rarely foregrounded during design. The building is optimised for completion rather than succession.

Taken together, these forces produce a condition of temporal compression. Buildings capable of standing for decades become economically and technically resistant to adaptation. The cost, complexity, and risk associated with intervention accumulate until replacement appears more rational than repair. These barriers are not inherent to contemporary materials or technologies. They result from choices about integration, servicing strategy, liability management, site response, and delivery models. When layers are collapsed and access pathways removed, opportunities for incremental care diminish. Repair shifts from routine practice

to an exceptional event. Extending housing longevity requires recognising these barriers as systemic. Repairability cannot be appended at the margins. It must be embedded within construction logic, regulatory settings, and economic frameworks so that intervention remains feasible, proportionate, and rational over time.

07.03. Cultural, Economic, and Regulatory Impacts

The case studies indicate that housing longevity in Aotearoa New Zealand is shaped not only by architectural assembly but by the cultural narratives, economic structures, and regulatory frameworks that define value, responsibility, and risk. A clear distinction emerging from the case studies concerns how ageing is interpreted. In earlier timber houses, such as those on Hanson Street and Takinga Street, ageing is gradual and legible. Weatherboards silver, paint weathers, and corrugated roofing oxidise gradually over time. These processes signal duration rather than imminent failure. Repair is understood as cyclical and expected. Painting, reroofing, and selective replacement are part of ongoing domestic stewardship. Because these buildings are constructed in layered and accessible ways, repair does not disrupt identity. Incremental extension or patching becomes part of the home's biography. Visible modification is absorbed into the character rather than read as a defect.

By contrast, contemporary monolithic construction often frames ageing as a form of vulnerability. Hairline cracks in rendered plaster indicate a risk of hidden moisture. Surface staining implies systemic weakness. The aesthetic depends on seamless continuity, and when that continuity is disrupted, repair is experienced as correction rather than care. Ageing becomes associated with technical failure rather than with endurance. These perceptions shape behaviour. Where maintenance is normalised, intervention tends to occur incrementally. Where it signals a crisis, action is deferred until unavoidable. A broader narrative also persists in which new housing is equated with progress and older housing with inefficiency. While early timber homes may present thermal limitations, the case studies demonstrate that such houses can be upgraded progressively without undermining their underlying repairable logic. When cultural narratives privilege replacement over adaptation, latent longevity is easily overlooked.

Economic structures further condition repair decisions. Housing in New Zealand operates as both shelter and investment. In high-value urban contexts, land appreciation can outpace the value of buildings. Under these conditions, redevelopment may yield a higher return than remediation, even when repair is technically feasible. Youngs Lane illustrates this dynamic. Comprehensive recladding would require substantial capital. When such investment approaches the projected value of redevelopment, repair becomes economically irrational. Lifespan is curtailed not by structural incapacity but by capital logic. In more stable contexts, incremental repair remains viable. Hanson Street and Takinga Street show how manageable maintenance aligns with continued occupation. When upgrades fall within realistic household budgets, renewal can occur

gradually. Longevity is sustained through cumulative investment rather than through a single capital expenditure. Tenure also influences economic behaviour. Shifts from owner-occupied to rental use, as observed on Takinga Street and Wade River Road, can alter maintenance incentives. When occupants are not long-term custodians, investment may be limited to compliance rather than proactive improvement. Economic structures shape not only whether repair occurs, but also the scale and timing of intervention.

Regulatory settings reinforce these cultural and economic pressures. The New Zealand Building Code focuses on performance compliance at the point of construction. Durability requirements are defined in terms of the minimum expected lifespan of components rather than adaptability or future access. There is limited emphasis on ensuring that systems remain accessible for modification. Following the leaky homes crisis, regulatory attention intensified around waterproofing performance and liability mitigation. Designers and builders operate within a risk-sensitive environment. Proprietary systems offer predictable compliance pathways and warranty assurances, yet they can reduce flexibility. Alterations may trigger consent processes or introduce liability uncertainty, raising the threshold for incremental change. Insurance frameworks further mediate behaviour. Intervening in sealed-envelope systems can affect coverage, discouraging preventive or exploratory modifications. Even modest alterations may require formal documentation and professional oversight, increasing cost and complexity. Regulation does not prohibit repair, but it can unintentionally privilege minimal interference over proactive adaptation. Buildings are optimised for certification and risk containment rather than for long-term modification. In this sense, contemporary housing is frequently certified for completion rather than designed for succession.

These forces do not operate independently. Cultural preference for seamless appearance supports integrated construction. Integrated construction increases remediation cost. Elevated remediation costs strengthen the economic case for redevelopment. Regulatory emphasis on risk mitigation reinforces conservative detailing and discourages experimentation with adaptable assemblies. Together, these systems can compress lifespan. Conversely, where layered construction aligns with cultural acceptance of maintenance, where incremental repair remains economically viable, and where regulatory processes do not unduly burden alteration, longevity accumulates. Hanson Street demonstrates such alignment, with accessible construction, cultural acceptance of ageing, and manageable investment reinforcing one another.

Extending housing longevity requires systemic recalibration. Cultural narratives must recognise repair as stewardship rather than as defect correction. Economic models must account for embodied carbon and social continuity alongside land value. Regulatory frameworks could place greater emphasis on accessibility and adaptability as dimensions of durability. Housing longevity is not solely an architectural outcome. It is produced through the interaction among design decisions, cultural expectations, market dynamics, and regulatory structures. When these systems align, buildings accumulate time and meaning. When they diverge, even technically durable structures face premature obsolescence.

07.04. Integrating Repairability into NZ Practice

If repairability is to become a meaningful contributor to housing longevity in Aotearoa New Zealand, it must be integrated into architectural practice, regulatory thinking, and construction culture rather than treated as an incidental by-product of material choice. The case studies show that adaptable homes are structured around access, legibility, and the anticipation of change. Translating these qualities into contemporary practice requires deliberate recalibration.

A foundational step is to maintain a clear distinction among structural, enclosure, and servicing systems so that intervention can occur without destabilising the whole. Where layers remain identifiable and independently accessible, failure can be isolated and addressed proportionately. This principle does not require aesthetic regression. It requires recognising that buildings will be opened, altered, and repaired across decades. In practical terms, this involves avoiding unnecessary structural loading of internal partitions, ensuring that service pathways remain accessible rather than embedded, and selecting cladding systems that localise rather than propagate failure. Separable systems reduce risk, simplify maintenance, and support cumulative modification over time.

Servicing strategy is central to long-term adaptability. Embedding plumbing within slabs or consolidating services within load-bearing cores restricts future reconfiguration. While slab-on-grade construction is common and efficient, alternative approaches, such as defined service corridors, accessible risers, or raised-floor zones, can preserve flexibility. In multi-storey housing, accessible vertical risers enable kitchens and bathrooms to be adapted without extensive demolition. Even modest decisions, such as ensuring roof-cavity access or leaving provision for future wiring upgrades, extend a home's capacity to accommodate technological and household change. Designing for service access acknowledges that domestic patterns and systems will shift across time.

Repairability is also shaped by how buildings engage their sites. The Wade River Road case demonstrates that technically separable systems can become burdensome when maintenance access is overlooked. Elevated façades, steep slopes, and complex geometries may effectively resolve site constraints, yet they also shape future care cycles. Design decisions should consider how routine tasks such as painting, cladding replacement, or window servicing will be undertaken. Simplifying façade articulation, incorporating passive weather protection, and reducing exposure where possible can significantly reduce long-term maintenance burden. Maintenance accessibility should be understood as a dimension of sustainability that influences environmental impact and economic viability throughout the building's lifespan.

Embedding repairability also requires reflection within regulatory and professional systems. Current durability provisions focus on minimum material lifespan rather than on accessibility for inspection and

replacement. Expanding regulatory guidance to encourage accessible service zones and adaptable layouts would better align compliance with long-term resilience. Consent processes could be streamlined for alterations that enhance performance without compromising safety, reducing friction around incremental improvement. Within professional culture, housing should be understood as a temporal project rather than a resolved object. Documentation that clearly communicates system organisation supports future intervention and extends design responsibility across time. Architectural education can reinforce this orientation by emphasising building anatomy, disassembly logic, and the ethics of long-term stewardship. Understanding how assemblies are repaired is as critical as understanding how they are constructed.

Repairability must also align with economic systems. Incentives for retrofit, recognition of embodied carbon savings, and policy settings that do not penalise renovation over demolition would recalibrate market logic toward renewal. At a domestic scale, designing houses that permit staged improvement supports households with limited capital. Incremental insulation upgrades, selective window replacement, and phased spatial adjustments allow performance enhancement without requiring a comprehensive rebuild. Repairability is directly linked to affordability and long-term value retention. This approach parallels broader right-to-repair movements that seek to restore user agency within technical systems, repositioning occupants not as passive consumers but as active custodians.

Finally, repairable construction must be positioned as forward-looking rather than nostalgic. Layered assemblies, accessible servicing, and adaptable planning are pragmatic responses to climate pressure, material constraint, and economic uncertainty. They are compatible with high-performance envelopes and contemporary technologies. The objective is not to prevent change, but to ensure that change remains feasible and proportionate. When separation, access, and maintenance awareness are embedded from the outset, longevity becomes a deliberate outcome rather than an accidental survival. Through prioritising legibility, service access, maintenance-conscious site response, and regulatory alignment, New Zealand housing practice can shift from replacement-oriented logic toward cumulative adaptability across generations.

07.05. The Role of the Homeowner as Caretaker

The case studies confirm that housing longevity is not produced by construction systems alone. It emerges through an ongoing relationship between home and occupant. Repairable architecture creates the conditions for care, yet care must be enacted. Without sustained custodianship, even adaptable buildings decline. Conversely, without accessible systems, even committed occupants encounter limits.

Hanson Street illustrates custodianship in its most generative form. Over time, the home has undergone incremental extensions, spatial adjustments, reroofing, insulation upgrades, and window replacement.

These interventions form a cumulative biography rather than a sequence of isolated corrections. This pattern reflects familiarity and stewardship. Occupants understand how the building is assembled and how it can be modified. Adaptation becomes embedded within everyday habitation rather than deferred to crisis. The house is reshaped in response to changing needs, and longevity is extended through ongoing engagement. Such engagement depends on legibility. When construction systems are understandable and accessible, the threshold for intervention lowers. Care becomes manageable rather than overwhelming.

Takinga Street demonstrates how this relationship can weaken. During long-term owner occupation, the home evolved in response to domestic change. Following its transition to rental tenure, maintenance slowed, and deterioration became visible. The structure remains capable of renewal, yet its realised longevity has stalled. This case highlights that repairable capacity alone is insufficient. Without consistent attention and investment, deterioration accumulates. The interruption lies not in the building's assembly but in the social relationship sustaining it. Tenure conditions can redistribute or dilute responsibility, reducing incentives for incremental improvement.

Youngs Lane further complicates the caretaker's role. Although owner-occupied and periodically updated, the system remains restrictive to meaningful intervention. Comprehensive remediation would require significant capital and specialist involvement. Embedded services and monolithic cladding limit spatial and material adjustment. Here, agency is constrained by construction logic. Commitment cannot overcome structural opacity. The homeowner's role shifts from steward to risk manager, navigating costs, compliance, and uncertainty rather than pursuing cumulative improvement. This case underscores that custodianship must be supported by accessible systems.

Wade River Road introduces a different limitation. The home is structurally sound and materially repairable, yet elevated façades and high-maintenance cladding increase logistical and financial burden. Routine upkeep requires specialist access, raising the threshold for timely intervention. When maintenance becomes disproportionate to household capacity, it is deferred. Deferred care accelerates deterioration. The caretaker role depends not only on willingness but also on proportionality. Architecture that amplifies maintenance complexity discourages stewardship.

Across the cases, longevity appears most robust where the relationship between home and occupant is reciprocal. In Hanson Street, the house adapts to its inhabitants, and they adapt in return. Change is negotiated rather than resisted. This orientation reflects principles consistent with kaitiakitanga, where stewardship entails ongoing responsibility across generations rather than short-term possession. Within this framework, the home is understood as something maintained and transmitted rather than consumed. When housing is framed primarily as a finite asset, this reciprocity weakens. Occupants become consumers of performance rather than participants in continuity.

Integrating repairability into practice requires reframing the homeowner as an active participant in a building's ongoing evolution. This does not suggest that occupants must undertake all technical labour, but it recognises that decisions regarding maintenance, adaptation, and investment fundamentally shape the survival of architecture. Design can support this role by ensuring documentation is accessible and spatial arrangements retain capacity for change. Conversely, opaque construction systems discourage engagement, distancing occupants from processes of care and repair. Policy settings play an equally important role in reinforcing custodianship. Incentives for retrofit, recognition of embodied carbon savings associated with repair, and support for skill development within maintenance trades collectively strengthen a culture of care. Housing longevity depends not only on individual intention but on the broader social, technical, and regulatory frameworks that enable sustained engagement with the built environment.

Ultimately, housing longevity is co-produced. Architects, builders, regulators, and occupants each shape the conditions under which buildings endure. Where accessible systems align with stable custodianship and manageable maintenance, homes accumulate time. Where agency is constrained by integration, economic pressure, or excessive burden, lifespan contracts. The homeowner-as-caretaker is neither a romantic ideal nor a singular solution. It is one essential component within a broader framework that must structurally enable stewardship. Repairable architecture invites care. Care, in turn, sustains architecture across generations.

07.06. Implications For housing Longevity

The case studies confirm that housing longevity is not produced by construction systems alone. It emerges through an ongoing relationship between home and occupant. Repairable architecture creates the conditions for care, yet care must be enacted. Without sustained custodianship, even adaptable buildings decline. Conversely, without accessible systems, even committed occupants encounter limits.

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Chapter 08: The Bicentennial Home

08.00. Introduction

Earlier chapters established that housing longevity in Aotearoa depends on preserving homeowner–building symbiosis through legible, accessible, and separable construction systems. Chapter 8 shifts from analysis to architectural organisation by translating these findings into a structured design framework.

This chapter argues that longevity can be embedded architecturally through disciplined hierarchy, open interfaces, and sustained knowledge continuity. Repairability is treated not as a maintenance afterthought but as an organising principle. The Bicentennial Home framework consolidates the thesis into spatial, material, and procedural commitments that protect the occupant's capacity to maintain, adapt, and transmit the dwelling across generations.

"Bicentennial" does not predict a fixed lifespan. It functions as a methodological horizon. A two-hundred-year timeframe compels consideration of successive ownership cycles, technological change, demographic shifts, climate adaptation, and regulatory transformation. It exceeds the lifespan of products, mortgages, and political cycles, and operates as a stress test. If an assembly cannot accommodate renewal, substitution, and reinterpretation across two centuries, its long-term viability is questionable.

The framework is derived from the thesis rather than imposed upon it. It synthesises layered construction logic, custodial ethics, economic and tenure conditions that shape maintenance capacity, and lessons drawn from case analysis. It does not prescribe a style or fixed technical solution. Instead, it defines the structural conditions that allow repair to remain feasible across time.

In moving from diagnosis to proposition, this chapter reframes renovation as an anticipated and continuous condition of habitation. The Bicentennial Home is not an image of permanence. It is an organisation of hierarchy, access, and continuity that safeguards the reciprocal relationship between dwelling and occupant. Through this reordering, housing in Aotearoa can shift from cycles of replacement toward enduring stewardship.

08.01. Structural Hierarchy and Layer Separation

Longevity begins with hierarchy. A home intended to remain serviceable across generations must distinguish clearly between elements expected to endure and those expected to change. When these roles are blurred, routine renewal destabilises primary fabric and minor interventions escalate into invasive reconstruction. Structural hierarchy is therefore the foundational commitment of the Bicentennial Home framework. By separating long-life structure from shorter-life enclosure, services, and fit-out, renewal can occur selectively rather than systemically.

At the core sits the structural frame. It carries gravity and lateral loads and establishes a stable spatial matrix capable of accommodating multiple interior configurations over time. Structural members remain distinct from partitions and service routes so that plan adjustments do not compromise stability. Internal walls are treated as changeable elements rather than structural necessities, allowing rooms to expand, contract, or merge without altering primary load paths.

The enclosure forms a secondary protective layer rather than a structural substitute. Cladding, cavities, and linings are detailed for removal without dismantling framing. Weather shedding and drainage are prioritised over sealed continuity so deterioration remains localised. Structural performance does not depend on cladding integrity.

Services constitute a faster layer organised through defined vertical and horizontal zones rather than dispersed unpredictably. Planned pathways allow upgrades without cumulative perforation of structural members. Fit-out elements, including cabinetry, fixtures, and finishes, are intentionally replaceable and dimensioned for independent removal so aesthetic or functional renewal does not disturb slower layers.

Separation does not imply fragmentation. Layers interface coherently, but connections allow disassembly in reverse order of construction. Interventions remain confined to their originating layer, preserving adjacent systems and maintaining intelligibility over time.

A two-hundred-year horizon clarifies structural limits and trade-offs. Medium-density housing introduces fire-rated separations that restrict disassembly. Foundations sized for immediate loads may constrain future extension. Rising seismic standards may require strengthening, and structural reserve capacity carries cost. Hierarchy does not remove these pressures. It ensures that reinforcement, extension, or reconfiguration proceeds with clear knowledge of load paths and capacity rather than through exploratory demolition.

Within the Bicentennial Home, hierarchy is not stylistic preference but structural discipline. By stabilising the core and separating faster layers, the dwelling enables proportionate adaptation and preserves homeowner–building symbiosis across generations.

08.02. Envelope and Damage Localisation

If structural hierarchy establishes what must endure, the envelope determines how environmental stress is managed. In Aotearoa's variable climate and seismic context, durability depends less on absolute impermeability than on the capacity to detect, isolate, and repair failure before it spreads. The Bicentennial Home therefore treats the envelope not as a sealed barrier, but as a layered and inspectable system that confines deterioration to replaceable components.

Past failures in entangled cladding and lining systems demonstrated that when protective layers become structurally interdependent, moisture can propagate into the primary fabric and become systemic. The response is not simply to use more durable materials, but to separate layers so that failure remains local rather than structural.

Claddings are mechanically fixed over ventilated cavities. Weather shedding, drainage, and drying are prioritised over continuous sealants. Joints are detailed to be cut and remade, and flashings remain accessible for inspection and replacement. External elements subject to weathering are treated as sacrificial layers with defined service lives, allowing renewal without disturbing structural framing.

Damage localisation extends beyond moisture. Movement, thermal expansion, and material fatigue are expected over decades. Clear tolerances and separations limit cracking and cumulative stress. Where sealants or bonded membranes are required, they are positioned so replacement can occur without dismantling adjacent assemblies. Intervention remains proportionate and visible.

A two-hundred-year horizon complicates this logic. Contemporary performance standards rely on continuous air barriers, vapour control layers, and uninterrupted insulation to improve thermal efficiency. These systems enhance performance but can conflict with disassembly when fused into composite assemblies. The Bicentennial framework does not reject high-performance envelopes. It requires that critical layers remain identifiable and repairable within the assembly. Airtightness must be achieved without rendering the envelope opaque. Performance and reversibility must be deliberately balanced.

Climate instability intensifies this requirement. Increased rainfall intensity, rising moisture loads, and more frequent extreme events will test envelopes beyond historical norms. In coastal or flood-prone areas, raised floor levels or sacrificial lower-storey linings may be necessary. A repair-first envelope anticipates not only routine weathering but also adaptation to shifting environmental baselines. Inspection zones, accessible roof spaces, and removable panels allow maintenance without destructive investigation, ensuring that environmental risk remains visible, contained, and correctable over time.

08.03. Access Systems and Service Legibility

Structural hierarchy stabilises the core, and the envelope confines environmental risk. Services determine whether the building can be maintained without disproportionate disruption. When plumbing, electrical, and data systems are embedded unpredictably within walls and ceilings, even minor faults require destructive investigation, discouraging maintenance and allowing small defects to escalate.

The Bicentennial Home treats services as a fast layer organised for legibility. Routing, connections, and isolation points are structured through deliberate zoning and documentation rather than concealed improvisation.

Service zones are defined early in the design process. Wet areas are grouped to limit the length of plumbing runs. Electrical and data routes are consolidated within accessible cavities or service chases instead of threaded through structural framing. Penetrations are located at controlled locations, limiting cumulative weakening of primary members and preserving structural clarity across successive upgrades.

Isolation points remain accessible. Shut-off valves, switchboards, and control systems are positioned for access without dismantling adjacent construction. Roof and subfloor spaces are dimensioned for meaningful inspection rather than minimal compliance. When faults can be quickly located and isolated, intervention remains local.

Renewal is anticipated. Pipes, cables, and ducts are mechanically fixed and capable of disconnection without damaging slower layers. Allowance is made for technological change in heating, energy storage, and communications, so that evolving systems can be upgraded without destabilising the structure or enclosure.

Legibility extends to informational continuity. As-built drawings, labelling, and a maintained log accompany the dwelling across ownership cycles. Each intervention adds to accumulated knowledge rather than erasing it, reinforcing the broader claim that custodianship depends on comprehension.

Over a two-hundred-year horizon, services will change more rapidly than structures or enclosures. By organising them into an accessible, intelligible layer, the Bicentennial Home ensures that technological renewal remains compatible with long-term structural and environmental integrity. The building remains comprehensible to those responsible for its care.

08.04. Fit-Out a Replaceable Layer Strategy

While structure and envelope are organised for endurance, interior fit-out operates on a shorter cycle. Kitchens, bathrooms, joinery, floor finishes, and built-in storage are subject to wear, technological change, and shifting patterns of use. When fused to slower layers, their renewal triggers disproportionate demolition. The Bicentennial Home, therefore, treats fit-out as an intentionally replaceable system within a stable architectural armature. Elements are mechanically fixed and dimensioned for removal, so renewal remains confined to this fast layer rather than cascading into the structure or enclosure.

Bathrooms and kitchens, as high-change zones, are clustered around established service cores. Concentration limits the spatial footprint of disruption and simplifies future reconfiguration. Flooring,

linings, and non-load-bearing partitions are detailed for removal without damaging substrates, ensuring that aesthetic or functional change does not compromise structural continuity.

Certain performance zones introduce unavoidable constraints. Waterproofing membranes in tiled wet areas are typically bonded systems required for compliance. These assemblies are not fully reversible, and renewal often requires partial removal of finishes. The Bicentennial framework accepts that complete separability is not always possible. Irreversible bonding is confined to defined zones, with edges and transitions detailed to permit inspection and localised repair where feasible. Reversibility is maximised within regulatory limits.

The replaceable fit-out layer also supports life-stage adaptation. Partitions can be added or removed without altering load paths, and storage systems can be reconfigured as household needs evolve. By designing interior elements for repeated removal and reinstallation, the dwelling accommodates change without destabilising primary fabric. Renewal becomes an anticipated condition of habitation rather than a structural threat.

08.05. Material Continuity and Open Interfaces

Over two centuries, products, manufacturers, and technologies will change. The Bicentennial Home therefore does not rely on fixed specifications or singular suppliers. It secures continuity through open interfaces and performance-defined substitution.

Material continuity refers to a building's capacity to accept compatible replacements without compromising performance. The objective is equivalence rather than replication. Structural members, claddings, linings, and fittings are dimensioned and detailed so that future components can be inserted within established tolerances. Interfaces are defined by measurable criteria, including load capacity, moisture management, fire resistance, acoustic performance, and dimensional coordination, rather than by proprietary geometries. Substitution remains possible even as products evolve.

Open interfaces are the technical expression of this principle. Junctions are mechanical and reversible wherever feasible. Fixings are visible or logically concealed to allow removal without collateral damage. Where bonding is unavoidable, it is confined to zones that can be accessed and remade. No primary assembly should depend on a single closed system that cannot be replaced if withdrawn from the market.

This logic becomes more complex in densified or multi-unit housing. Fire-rated separations, acoustic assemblies, and shared infrastructure restrict free disassembly. The framework does not assume universal reversibility. Instead, it requires that fire and acoustic assemblies be designed as identifiable systems with defined performance criteria, so that renewal or upgrading can occur without compromising adjacent dwellings. In this context, open interfaces support both compliance and maintainability.

Material continuity also allows improvement. Higher-performing glazing, lower-carbon materials, or advanced prefabricated systems may become available over time. When interfaces are open and assemblies separable, such upgrades can occur without dismantling structural cores. The building evolves materially while preserving organisational clarity.

Resilience therefore does not depend on material austerity, but on transparency and substitutability. Technologies that can be repaired, upgraded, or replaced within a coherent interface are compatible with the Bicentennial framework. Technologies that create irreversible dependency are not.

Through performance-defined assemblies and accessible junctions, the Bicentennial Home resists lock-in while remaining open to change. Over time, many components will be renewed. What endures is not a fixed palette of materials, but a stable relationship between layers that allows future custodians to continue the building without starting again.

08.06. Documentation and Knowledge Transfer

Repairability does not reside in construction alone. It depends on whether knowledge about the building survives changes in ownership and technology. When drawings disappear, and alterations go unrecorded, even repairable assemblies become opaque.

Knowledge transfer begins at handover. A complete and intelligible record accompanies the home, including as-built drawings, service layouts, structural information, maintenance schedules, and product data. Organised as a working log rather than archival paperwork, it explains the building's logic, identifies inspection points, and outlines expected renewal cycles for different layers. Documentation becomes the means by which homeowner-building symbiosis is transmitted across generations.

Each intervention adds to this record. Alterations, upgrades, and repairs are documented with dates, methods, and materials, creating a traceable history of care. Future occupants and trades do not have to rediscover the building through destructive methods. Repair becomes informed rather than speculative.

Material registers record dimensions, tolerances, and performance criteria so compatible components can be sourced if original products are discontinued. Documentation reinforces the open-interface strategy by transforming substitution from improvisation into deliberate practice.

Legibility is reinforced physically as well as textually. Service isolation points, structural elements, and access hatches are marked clearly within the building so its organisation remains understandable in use.

Maintenance schedules distinguish slow and fast layers, clarifying responsibility and making the rhythm of renewal visible. Repair is framed as routine stewardship rather than crisis response.

Records may be digital or physical, but they must remain accessible and transferable. Informational durability requires ongoing care.

Across two centuries, multiple custodians will inherit the dwelling. Documentation ensures that each receives not only fabric but understanding. Repairability becomes cumulative rather than episodic, and the building grows more intelligible over time. In this way, documentation completes the framework by preserving the occupant's capacity to act within an organised hierarchy.

8.07 Tensions and Trade-Offs

The Bicentennial Home does not eliminate tensions between durability, compliance, cost, and adaptability. Designing for two centuries requires negotiation between competing demands. The framework does not assume frictionless separability. It requires disciplined judgement about where continuity must prevail and where irreversibility is unavoidable.

A persistent tension lies between airtightness and disassembly. Contemporary performance standards rely on continuous air barriers, vapour control layers, and uninterrupted insulation to reduce heat loss and condensation risk. These systems depend on continuity, which can conflict with inspectability and reversibility. When membranes are fused into composite assemblies, later access becomes difficult. The framework does not reject high-performance envelopes, but it requires that critical layers remain identifiable and repairable. Performance and reversibility must be deliberately balanced.

Fire separation introduces a related constraint, particularly in medium-density housing. Fire-rated walls and floors rely on tested assemblies, sealed junctions, and controlled penetrations. Acoustic separation similarly depends on mass and continuity. These requirements limit disassembly and restrict substitution. Some layers must prioritise life safety and collective performance over individual replaceability. The framework accepts that certain assemblies will remain more fixed, while insisting that their boundaries and performance criteria remain legible and documented.

Cost further complicates longevity. Structural reserve capacity, oversized foundations, or allowance for future strengthening increase upfront expenditure. Within speculative development models driven by short return cycles, such provisions are difficult to justify. A repair-first approach can conflict with financial systems that prioritise immediate efficiency over long-term resilience. The bicentennial horizon reframes these pressures as decisions about how risk is distributed across time.

Regulatory compliance may also necessitate proprietary systems. Certified fire assemblies, façade systems, and prefabricated structural components are often tied to specific manufacturers and tested configurations. Certification regimes constrain open substitution in order to guarantee performance. The framework resists unnecessary lock-in but operates within these conditions. Where proprietary systems are required, their interfaces should remain as open and well-documented as possible to prevent dependency in adjacent layers.

Densification introduces additional complexity. In multi-unit housing, shared services, inter-tenancy walls, and collective maintenance regimes shift repair from individual to collective scale. Individual dwellings no longer control all layers of the envelope or infrastructure. The principles of hierarchy, legibility, and documentation still apply, but custodianship becomes a matter of shared governance.

By acknowledging these trade-offs, the Bicentennial Home avoids idealisation. It does not promise unlimited adaptability. It proposes an architecture that recognises constraints and organises them transparently. Longevity emerges not from eliminating tension, but from managing it with clarity so custodians understand both the capacities and the limits of the building they inherit.

08.08. Synthesis

This chapter shifts the thesis from analysis to architectural organisation. Earlier chapters established that longevity in Aotearoa housing depends on legibility, separability, and sustained custodianship. Here, those conditions are consolidated into a coherent structural framework. The Bicentennial Home is neither stylistic proposal nor technical checklist, but a reordering of domestic construction in relation to time, maintenance, and ownership succession.

Longevity is therefore not material endurance alone, but continuity of agency. A dwelling remains viable when its custodians can understand it, intervene proportionately, and transmit that understanding forward. The framework embeds this capacity spatially, materially, and procedurally. It anticipates turnover, regulatory shifts, technological change, and climate pressure, structuring the building so these forces can be negotiated rather than resisted.

The two-hundred-year span clarifies the distinction between durability and serviceability. Components will be replaced. Assemblies will be strengthened or upgraded. What endures is not untouched fabric, but an organisational logic that prevents entanglement and preserves intelligibility. Identity resides in relationships between layers rather than in static material form.

Renovation becomes a continuous condition rather than a terminal event. Repair is anticipated rather than exceptional. The dwelling is conceived not as a consumable asset delivered at completion, but as an evolving framework designed to remain usable across successive ownership cycles.

The Bicentennial Home demonstrates that housing longevity in Aotearoa can be embedded architecturally. By structuring buildings so occupants can maintain, repair, and adapt them with clarity and proportionality, the reciprocal relationship between people and dwelling is preserved. Longevity emerges not from resisting change, but from organising it.

Chapter 09: Standalone Manifesto

The Six Commitments of the Bicentennial Home

A Repair-First Framework for Occupant Stewardship

Housing longevity in Aotearoa does not arise primarily from stronger materials or higher technical performance. It arises from preserving the symbiotic relationship between dwelling and occupant. A home endures when its custodians can understand it, maintain it, and adapt it without fear of destabilising it. Architecture that seeks to last must therefore be organised around this relationship. Every design decision, structural, material, or procedural, must be made with the question: how will this be cared for?

The Bicentennial Home is defined through six commitments that protect this symbiosis. They are not stylistic choices. They are structural conditions that maintain the occupant's capacity to participate in the building's life across generations.

1. Structural Hierarchy

Protect the core so people can change the rest.

The structural frame is clearly separated from changeable elements, with load-bearing systems that are durable and legible, while partitions and secondary layers remain adaptable. This distinction enables occupants to alter spatial arrangements, respond to changes in life stages, and reconfigure rooms without compromising structural stability. Adaptation becomes achievable rather than intimidating, as the building safeguards its core to ensure safe modifications around it, thereby maintaining occupant agency over time.

2. Envelope Separability and Damage Localisation

Make failure visible, containable, and repairable.

Protective layers are attached so that deterioration remains visible and confined to replaceable components. Environmental stress is managed through layered defence rather than concealed dependency.

When failure is localised, it can be addressed early and proportionately. Maintenance becomes routine practice instead of catastrophic reconstruction. The building supports attentiveness and rewards care. It does not punish small oversight with irreversible structural decay.

3. Service Legibility and Access

Organise infrastructure so it can be understood and worked on.

Infrastructure is organised to be understood. Plumbing, electrical, and data systems are routed through predictable zones, and isolation points remain accessible.

Clarity reduces uncertainty and lowers the barrier to maintenance. Trades can intervene precisely, and informed homeowners can understand what is occurring within their walls. The building does not conceal its workings. It remains legible to those responsible for it.

4. Replaceable Fit-Out

Allow everyday renewal without structural sacrifice.

Interior finishes and wet areas are treated as short-cycle layers within a stable host structure. They are detailed for removal and substitution without disturbing slower structural and enclosure systems.

This acknowledges the reality of renovation culture in Aotearoa. Occupants personalise, improve, and update their homes over time. When renewal is anticipated within the design, such change does not produce disproportionate waste or structural damage. The home accommodates participation rather than resisting it.

5. Open Interfaces and Performance-Defined Substitution

Resist lock-in and protect future choice.

Assemblies are defined by performance rather than proprietary form. Junctions allow components to be replaced with equivalent materials as technologies and standards evolve.

Future custodians are not locked into discontinued systems or singular suppliers. The building accepts improvement and substitution without requiring total replacement. Choice remains possible across generations, protecting long-term autonomy.

6. Documentation and Knowledge Continuity

Ensure understanding survives ownership change.

Understanding is preserved alongside fabric. As-built drawings, service maps, material registers, and maintenance records accompany the dwelling across ownership cycles.

Knowledge becomes cumulative. Each custodian inherits both the building and an intelligible record of how it functions. Care does not begin from ignorance. The relationship between occupant and dwelling is transmitted rather than reset.

The Core Claim

Together, these commitments reorganise domestic architecture around a single premise: a home endures when its occupants remain capable of caring for it. Longevity, in this sense, is not merely material endurance but continuity of participation, the sustained ability of inhabitants to inspect, repair, modify, and understand their dwelling over time. The Bicentennial Home does not rely on flawless construction or static occupation; it protects the conditions under which stewardship can remain active and confident across generations. By embedding hierarchy, separability, access, and knowledge continuity within the building's structure, the dwelling remains an intelligible partner in habitation rather than an opaque product. If architecture is to endure across two centuries, it must be organised not only to resist decay, but to invite and support ongoing care.

Chapter 10: Conclusions

10.01. Reframing the Research Question

In this thesis, we have seen that housing in Aotearoa is increasingly treated as disposable. Integrated and proprietary construction systems limit selective repair and turn minor failures into disproportionate interventions. Under intensifying densification pressures, this logic becomes more consequential, concentrating materials, energy, and social life within buildings that are difficult to adapt incrementally. At the same time, custodianship weakens when homes are no longer legible or workable by their occupants. The result is a housing system that defaults to demolition rather than renewal.

This thesis, therefore, reframes its central question as:

How can housing in Aotearoa be designed as a long-lived, repairable framework that sustains custodianship across generations?

This thesis has shown that the answer lies in reordering the relationship between the building and the occupant. Housing longevity is achieved when dwellings are conceived as enduring frameworks capable of change, rather than as finished objects resistant to it. When change can occur incrementally, without destabilising the whole, repair becomes routine rather than exceptional. Knowledge can accumulate across ownership cycles instead of being lost, and care becomes structurally possible rather than dependent on luck. In this way, architectural organisation supports custodianship and aligns with the cultural values of kaitiakitanga that have long shaped practices of stewardship in Aotearoa.

10.02. Summary of Research Contributions

This thesis advances a central claim: housing longevity in Aotearoa depends on preserving homeowner–building symbiosis through construction systems that remain legible, accessible, separable, and open across successive cycles of change.

Housing longevity is not secured through material robustness alone, nor through nostalgic return to historic form, but through a deliberate architectural reorganisation of how dwellings are conceived, maintained, adapted, and inhabited. Its contribution is theoretical, methodological, and practical.

10.01.1. Theoretical Contribution

This thesis reframes housing longevity as a condition of symbiosis between dwelling and inhabitant. In this formulation, symbiosis is not metaphorical but structural. Construction systems are organised to invite intervention, and occupants are positioned as active maintainers rather than passive consumers. Durability is therefore not resistance to change but the capacity to absorb change through continuous care, adaptation, and renewal. Longevity emerges from an ongoing relationship rather than from completion.

Building on this position, the thesis advances Design for Renovation as a distinct architectural condition. Unlike Design for Disassembly, which prioritises end-of-life material recovery, Design for Renovation centres on extending service life through ongoing maintenance, incremental repair, and cyclical upgrading within lived regulatory and tenure contexts. Repairability is understood not simply as technical removability, but as a systemic relationship between construction logic, compliance pathways, economic thresholds, and everyday custodianship.

Within this framework, repairability is established as a primary organising principle of design. Rather than treating repair as post-failure maintenance, the research positions it as a determinant of structural hierarchy, layer separation, access strategy, and interface logic from the outset. The thesis identifies three interdependent conditions required to sustain repairability over time: physical accessibility, cultural participation, and systemic support. Longevity depends on their alignment rather than on material robustness alone.

The thesis clarifies the distinction between repairability and modularity within the New Zealand context. By assigning these logics to appropriate layers, slow layers prioritise preservation while fast layers accommodate substitution. This separation prevents circular economy ambitions from unintentionally reinforcing disposability and reinforces an understanding of architecture as process rather than product. Buildings endure through interaction, maintenance, and renewal rather than static form.

The research also integrates Te Ao Māori concepts of kaitiakitanga and whakapapa into the logic of architectural systems, alongside Aotearoa's longstanding DIY culture of homeowner maintenance and incremental modification. Custodianship is translated into material practices, documentation continuity, open interfaces, and intergenerational legibility, while DIY stewardship is recognised as a practical expression of this ethic within everyday housing. Repairability is situated within Aotearoa's cultural and regulatory context rather than framed solely through imported discourse.

10.01.2. Methodological Contribution

This thesis develops a comparative analytical method that places repairable and non-repairable housing in direct contrast. Through case and counter-case studies, it demonstrates that longevity is structurally produced through construction logic, access strategy, and system integration, rather than determined by age or style.

The research advances a cross-layer repairability framework and associated Repairability Index grounded in shearing layers theory, open building principles, and right-to-repair discourse, adapted to Aotearoa's climatic, seismic, regulatory, and cultural conditions. This framework clarifies how hierarchy, envelope separability, service legibility, and documentation continuity operate together as a system.

These findings are synthesised into the Bicentennial Home, not as a proposal, but as a conceptual device. The two-hundred-year horizon functions as a stress test, exposing which assemblies can withstand successive ownership cycles, technological change, and regulatory evolution. The Bicentennial Home consolidates dispersed principles into a coherent architectural logic.

10.01.3. Practical Contribution

This thesis defines the Six Commitments as minimum conditions for repair-first housing: structural hierarchy, envelope separability, service legibility, replaceable fit-out, open interfaces, and documentation continuity. Together, they establish a disciplined framework for long-term serviceability.

It distinguishes enduring human needs, including comfort, privacy, flexibility, and connection, from transient architectural trends. This separation protects the dwelling's structural and spatial core while allowing aesthetic evolution without systemic disruption.

Finally, the research demonstrates that repairability is a measurable design condition. It can be specified and evaluated through access strategies, reversibility of fixings, openness of interfaces, damage localisation, and durable documentation. Within New Zealand's performance-based regulatory environment, repairability becomes specifiable, consentable, and verifiable.

Synthesis

Taken together, these contributions reposition housing in Aotearoa from a short-cycle commodity toward a long-lived, adaptable framework sustained by custodianship. The thesis further clarifies that sustainable densification depends not only on increasing housing supply, but on ensuring intensified housing remains repairable across extended lifecycles. Endurance is achieved not through greater technical complexity, but through clearer systems and disciplined architectural hierarchy.

10.03. Practical Applications for Architects and Builders

The findings of this thesis translate directly into design and construction practice. Repairability is not an abstract ethic. It is achieved through deliberate architectural decisions made at the concept, developed design, detailing, and handover stages.

The following principles operationalise a repair-first approach in Aotearoa.

1. Prioritise the Occupant as Active Maintainer

   Place the user at the centre of design decisions.

   Routine maintenance should be safe, affordable, and possible without demolition. Details should anticipate cleaning, resealing, repainting, component replacement, and service upgrades. Isolation points must be reachable. Gutters must be cleanable. Linings likely to be removed should be mechanically fixed rather than bonded.

   Where ongoing care would require destructive access or disproportionate specialist intervention, the detail warrants reconsideration. Repairability begins with the assumption that buildings will be maintained by occupants as well as by contractors.

2. Separate Slow and Fast Layers

   Establish structural hierarchy from the outset.

   Primary structure and foundational elements should be detailed for long duration. Partitions, services, linings, claddings, and fit-out should remain non-structural unless explicitly required. Spatial change and service renewal must occur without disturbing load-bearing systems. Clear hierarchy ensures adaptation remains proportionate.

3. Design for Access and Service Concentration

   Access must be designed, not assumed.

   Service routes require visible or logically concealed hatches. Isolation valves, junctions, and inspection points should be labelled and reachable without demolition. Wet areas and high-change zones should be concentrated around defined service cores, reducing penetrations and simplifying renewal. Planned access and clustered services keep intervention local and controlled.

4. Maintain Separation Between Layers

   Elements that change at different rates should not be fused.

   Mechanical fixings are preferable where future separation is anticipated. Sealants should be confined to replaceable zones. Transitions between slow and fast layers must remain clear and reversible. Specifications should define performance and dimensional requirements rather than proprietary brands, allowing compatible substitution as supply chains evolve. Layer clarity preserves future flexibility and reduces long-term dependency.

5. Provide a Building Logbook

   Every dwelling should be handed over with durable documentation.

   As-built drawings, service layouts, product data, maintenance intervals, compliance certificates, and records of work should be consolidated in an accessible logbook structured for updating across ownership cycles. Continuity of knowledge enables confident, targeted intervention.

6. Test Disassembly Before Construction

   Assemblies should be prototyped and dismantled during the detailing stage.

   If a junction cannot be taken apart without damage in a mock-up, it will not become repairable in practice. Testing verifies that drawings translate into real reversibility. Repairability must be confirmed before construction.

Repairability does not diminish architectural quality; it disciplines it through clarity of hierarchy, precision of junction, and honesty of assembly, requiring materials to express their roles and systems to remain legible, reducing arbitrary complexity and strengthening conceptual coherence so that architecture designed for renewal is not compromised but refined.

10.04. Regulatory Implications

The findings of this thesis sit within, rather than outside, Aotearoa New Zealand's existing regulatory framework. Nothing in the current system prevents the design of repairable housing. The primary barrier is not legislative prohibition but cultural interpretation and design intent.

New Zealand's Building Code is performance-based. Designers must demonstrate compliance with stated outcomes rather than follow prescribed construction methods. This structure accommodates repairability.

Structural hierarchy, layer separation, accessible services, and reversible detailing can all be justified as valid means of achieving durability, moisture control, structural stability, and safety. Sealed systems and proprietary lock-in arise from convention, not regulatory requirement.

Clause B2 Durability can be understood not only as resistance to decay over a fixed timeframe, but as the capacity to sustain performance across successive cycles of maintenance and renewal. Assemblies designed for inspection, access, and selective replacement provide a legitimate pathway to maintaining compliance over time.

Schedule 1 provisions already permit certain repairs and comparable replacements to proceed without full consent, provided performance is maintained. When construction systems are legible and separable, these pathways are practicable. Similarly, specifications defined by performance and dimensions rather than by brand names enable product substitution within the Code's logic, provided compliance can be demonstrated.

In multi-unit housing, long-term maintenance plans and compliance schedules formalise cyclical inspections and renewals. Repairability strengthens these mechanisms by making planned interventions technically feasible and proportionate, reducing the likelihood that minor defects escalate into building-wide disruption.

The regulatory environment already contains the mechanisms necessary to support repairable housing. The challenge lies in how architects, builders, and consenting authorities interpret durability, performance, and substitution. Repairability requires a shift in professional expectation rather than a statutory overhaul. That said, a more explicit and robust Right to Repair framework within building and consumer law could further reinforce this position by clarifying access to information, ensuring availability of compatible components, and strengthening the long-term viability of open systems. Such reform would not introduce a new principle, but would formalise and stabilise the conditions that repair-first design already assumes.

10.05. Limitations and Reflections

This thesis operates as architectural and theoretical research rather than technical optimisation. Several limitations are acknowledged.

No quantitative lifecycle modelling has been undertaken. The embodied carbon implications of repairability are argued conceptually and comparatively rather than through measured simulation.

No detailed cost modelling has been performed. The economic implications of repair-first detailing, both initial and long-term, are not tested through extended financial analysis.

The research does not empirically test homeowner behaviour. The argument that legible and accessible systems encourage custodianship is grounded in historical precedent and cultural analysis rather than behavioural study.

The two-hundred-year horizon used in the Bicentennial Home is heuristic. It functions as a stress test for design decisions rather than a predictive claim about actual building lifespans.

The Bicentennial Home is presented as a conceptual framework rather than a constructed prototype. It synthesises principles into a coherent architectural logic without resolving them into a singular built example.

There are also structural tensions that remain unresolved. Repair-first design assumes a degree of custodianship that may be challenged by declining rates of owner-occupation, developer-led housing production, and short investment cycles. Some repairability strategies may increase initial design or construction cost, even if they reduce long-term volatility. These tensions sit within broader economic and institutional conditions that architecture alone cannot fully control.

These limitations are deliberate in scope. The thesis operates at the architectural-ethical level rather than at the level of product optimisation or engineering refinement. Its contribution lies in clarifying principles, hierarchies, and responsibilities that precede technical calculation. By repositioning repairability as a core design condition and custodianship as a structural relationship, the research establishes a foundation for quantitative, economic, and empirical studies.

The work does not claim to resolve every variable within housing production. It demonstrates that an alternative architectural logic is both possible and internally coherent within the New Zealand context.

10.06. Pathways for Future Research

This thesis establishes repairability as an architectural, cultural, and regulatory condition. The next stage of inquiry can extend this foundation into quantitative, economic, and empirical domains. The following pathways develop the work outward rather than revising it.

1. Quantitative Lifecycle Carbon Analysis

   A comparative study measuring embodied and operational carbon across fifty to one-hundred-year cycles could test repairable assemblies against sealed, replacement-driven systems.

   Such research would model selective renewal against full strip-out scenarios, measuring cumulative emissions associated with material throughput, transport, and demolition waste. This would

translate the environmental argument advanced in this thesis into measurable carbon accounting aligned with national reporting frameworks.

2. Long-Horizon Cost Modelling

   Financial modelling over extended cycles, potentially one hundred years, would clarify the economic implications of repair-first design.

   This could include staged maintenance costs, component replacement intervals, and avoided demolition. The aim would be to test whether structural hierarchy and layer separation reduce lifetime cost volatility when compared with integrated systems.

3. Policy Trials Linking Repairability to Consenting Incentives

   While this thesis does not advocate regulatory reform, future research could examine whether repairability criteria might be recognised within consenting processes.

   Pilot programmes could test whether documented access strategies, reversible detailing, or building logbooks reduce inspection burden, variation in consent, or lifecycle risk. This would examine the practical alignment between performance-based code logic and repair-first design.

4. Multi-Unit Governance and Repair Models

   As densification increases, research into repair governance in multi-unit developments becomes increasingly important.

   Future studies could investigate how body corporate structures, long-term maintenance plans, and shared service cores operate in buildings designed with explicit layer separation. Comparative research between conventional and repair-first multi-unit housing would clarify how governance structures support or constrain incremental renewal.

5. Empirical Study of DIY Custodianship Capacity in Aotearoa

   The thesis positions DIY stewardship as culturally embedded, yet contemporary capacity remains uneven.

   Empirical research could survey households to assess skill levels, confidence, willingness to maintain, and barriers to participation. This would test the assumption that legible systems activate custodianship and inform education, training, and documentation strategies.

Taken together, these pathways extend the architectural-ethical framework established here into measurable performance, economic modelling, governance systems, and lived experience.

The central claim remains stable. Repairability is a structural condition of housing longevity. Future research can now test, quantify, and refine its implementation across Aotearoa's evolving housing landscape.

10.07. Final Provocation

A house is not a product delivered at completion. It is an inheritance in motion, shaped by successive acts of care, adaptation, and renewal. When dwellings are treated as sealed commodities, their failures become terminal. When they are conceived as legible, accessible frameworks, failure becomes manageable and life extends through incremental intervention. Longevity is not achieved by resisting change but by designing for it, structuring buildings so that they can be entered, understood, and maintained without disproportionate disruption.

Repair, in this context, is not secondary labour. It is an architectural act. It is the disciplined continuation of design across generations. A housing culture that values repair affirms custodianship over consumption and continuity over replacement. The enduring relevance of New Zealand's housing will depend not on building faster or more tightly sealed systems, but on constructing dwellings that remain open to care.

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