Sustainable Business Network | CONSTRUCTION SECTOR ACCORD

# Industry-led Implementation Plan for Circular Construction

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# Foreword

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By its very nature, construction is the act of building. At present, building is generally undertaken with new materials that are destined for landfill after a short, single ‘life’. But our rates of resource use are unsustainable. New Zealand is using resources at nearly four times the rate than nature can replenish. The day is fast approaching where ‘new’ building will simply not be possible - environmentally, economically or legislatively.

So let’s get prepared by adopting circular economy principles in construction now.  Not sure how? That’s the aim of this document. To highlight the individual actions that we can undertake to begin the transition towards a sector where designing out waste, reducing and reusing materials is actively encouraged and desirable. Where materials are created and used with respect for the valuable resources that they are.  And where we take pride in making construction that is adaptable, durable and repairable.

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The construction sector in Aotearoa New Zealand stands at an important crossroads, facing significant challenges but also exciting opportunities for positive change. This Implementation Plan charts a course towards realising those opportunities by embracing circular economy principles over the next five years.

The sector currently generates too much waste. By reimagining how we design, build and manage projects, we have a real opportunity to dramatically reduce waste, extend the lifespan of buildings and materials and improve resource efficiency. These changes will unlock substantial environmental benefits as well as cost savings.

Developed through extensive input from industry stakeholders, this plan reflects a pathway to achieving a shared vision for a more sustainable future. While it doesn’t promise complete circularity within five years, it lays a strong foundation for transformative progress.

The roadmap presented here outlines ambitious yet achievable plans that can drive meaningful improvements across the sector. By embracing these practices, the sector can significantly reduce its environmental footprint, enhance resource efficiency, and create new value streams

As we embark on this journey, this plan provides a foundation for more sustainable and innovative practices, positioning the sector to thrive. Of course a plan is worthless without action. We have a collective responsibility to drive the actions outlined here to achieve the potential of the sector.

# Introduction

The construction sector is a key pillar of the New Zealand economy. It constitutes 6.3% of GDP [1]. It provides employment for more than 300,000 people, around 10% of the total workforce [2]. The sector is made up of more than 80,000 businesses and in 2023, it accounted for 8% of all imports [3].

But it also presents significant challenges in its contribution to waste generation and embodied carbon emissions. Construction and demolition contribute up to 50% of waste to Class 1 landfills in the country [4]. Construction materials and waste account for a substantial portion of embodied carbon emissions [5].

To align with New Zealand's environmental commitments, particularly its goal of achieving net-zero carbon by 2050, the construction industry must undergo transformative change. The adoption of low-carbon, waste-minimising products, materials, practices and technologies is essential. Embracing circular economy principles offers a pathway to not only mitigate environmental impact but also foster innovation and resilience within the sector.

This Implementation Plan outlines a series of industry-led actions within eight 'points of intervention'. It spans from the present until 2030. It aims to steer the construction sector towards circularity and sustainability. It underscores the urgent need for collaboration and a concerted effort across all stakeholders. This includes clients, architects, developers, material suppliers, contractors, builders, consultants, end-of-life solutions providers and regulators. By fostering collective responsibility and innovation, this plan strives to pave the way for a more resilient, low-carbon, circular construction sector.

**Points of Intervention:**

The points of intervention represent strategic areas for actively intervening within the system to drive maximum change. Collectively, they establish a framework for a comprehensive approach to waste reduction within the construction sector. Interlinked and mutually reinforcing, each point of intervention builds upon the others, forming a cohesive strategy. We have identified eight key points of intervention that are essential for addressing construction and demolition waste in Aotearoa New Zealand.

Actions outlined within the points of intervention have been provided by industry stakeholders at workshops and direct interviews.

## Circular Economy Framework

This construction specific framework* is useful in bringing circular economy principles to life.

**Build Nothing** by refusing unnecessary new construction.

**Build for Long Term Value** increasing building utilisation and designing for longevity, adaptability, disassembly and re-use of materials at the outset.

**Build Efficiently** by refusing unnecessary components and increasing material efficiency.

**Build with the Right Materials** by reducing the use of virgin material, use of carbon intensive materials and designing out hazardous/pollutant materials.

*From ARUP and Ellen MacArthur Foundation [6]

INTERVENTION POINT 01

# Design

Circular outcomes should be designed-in at the outset of projects to enable longevity, adaptability and the deconstruction and reuse of materials.

## Why?

We need to stop producing waste in the first place. This is best achieved at the design stage. By embedding circular principles at the outset of projects, we can fundamentally alter the trajectory of material usage and disposal and associated greenhouse gas emissions.

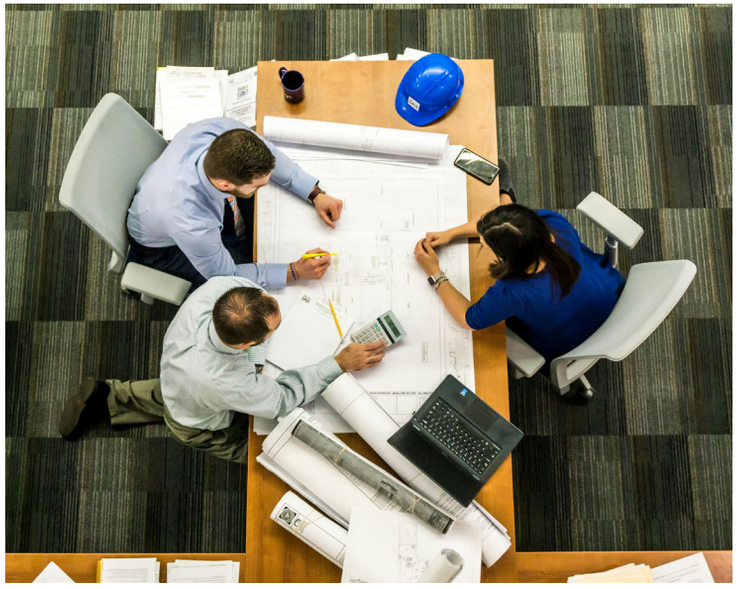
### 1.1 Use Integrated Design Process (IDP) to foster a shared understanding among project participants to optimise the efficiency, whole of life value, and future use of a building at the design stage.

IDP considers the architectural, engineering and building inputs of construction as a whole system. It involves multiple cross-disciplinary stakeholders and seeks to gather more input and discussion at the planning and design phases, with decisions made jointly by participants. The IDP system is iterative and considers the connections between the various disciplines.

Joint decision-making creates a more robust and considered initial design, with better communication across the value chain leading to improved environmental outcomes. The process can identify points of improvement and build them into construction design with regard to: functionality, operation, material selection, material efficiency, waste creation, end-of-life deconstruction and reuse, amongst others. Here, we see IDP as an effective tool to reduce waste. However, collaboration across the value chain can also save time and money.

### 1.2 Advocate for the use and development of circular building products, solutions, frameworks and practices.

By championing circularity in product development, we can prioritise resource efficiency, longevity and end-of-life considerations. This means designing solutions that not only meet customer needs, but also prioritise the utilisation of safe, renewable materials while promoting durability, repairability and recyclability throughout the product lifecycle.



## 1.1 Use Integrated Design Process (IDP) to foster a shared understanding among project participants to optimise the efficiency, whole of life value, and future use of a building at the design stage.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 1.1.1 | Create a guide for using IDP in construction projects. | Industry stakeholders, NGOs | ✓ | 2024 |
| 1.1.2 | Work with design and construction industry associations and educational institutions to increase awareness and knowledge of IDP. | Industry associations, educational institutions | ✓ | Ongoing<br>2024 - 2030 |
| 1.1.3 | Develop and publish case studies of successful IDP projects and their impacts. | Industry stakeholders, industry assocations | ✓ | Ongoing<br>2024 - 2030 |
| 1.1.4 | Introduce IDP categories to industry award programmes. | Industry associations | | 2025 onward |

## 1.2 Advocate for the use and development of circular building products, solutions, frameworks and practices.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 1.2.1 | Profile circular building products and solutions via directories such the Circular Economy Directory. | Industry associations, industry stakeholders, NGOs | ✓ | Ongoing<br>2024 - 2030 |
| 1.2.2 | Collaborate across industry to standardise building components. | Industry stakeholders (clients, architects, manufacturers) | | Ongoing<br>2025 - 2030 |
| 1.2.3 | Drive awareness and offer training to maximise material efficiencies and selection of most appropriate materials. | Industry assocations, research associations, educational facilities | | Ongoing<br>2025 - 2030 |

INTERVENTION POINT 02

# Demand

Customers need to demand circular solutions in their procurement processes. Ideally these should outperform, and at a minimum match, the linear economy alternatives in cost, desirability and functionality.

## Why?

By seeking out and demanding circular products and practices in procurement processes, customers can influence trends and industry standards. It is essential that circular solutions not only meet but surpass the performance, cost-effectiveness and desirability of linear economy alternatives. This will help incentivise widespread adoption.

**2.1 Change mindsets by improving awareness of and commitment to improving environmental outcomes.**

Poor perceptions about the need, feasibility and value of reducing construction and demolition waste need to be overcome. Changing mindsets is essential. Winning hearts and minds takes time, education and evidence. But this will help the sector reduce waste in the long run.

From clients, architects and engineers through to onsite contractors and logistics providers, creating awareness of the huge amount of waste created in construction and demolition is the first step. The next step is fostering an environment where all stakeholders commit to addressing, accounting for and improving environmental outcomes. By establishing an education programme for clients to learn about the value of, and how to ask for, improved environmental performance in construction work, they can initiate a push for better solutions. In addition, benefits such as cost savings should be communicated widely to encourage waste reduction.

**2.2 Use procurement and contracting to minimise waste.**

Procurement can play a vital role in construction waste reduction. Including circular principles in procurement and contract processes is an effective and direct way of creating positive change.

To maximise waste reduction and recovery on a project, good practice must be adopted at the earliest possible stage. It needs to be mandated through the procurement and contracting process. Planned actions, metrics and targeted outcomes should be communicated between the client and contractor. These should also be passed down the supply chain. This includes design and consultancy teams, subcontractors, waste management contractors and material suppliers. Good practice in procurement and contracting also needs to include all project phases – from option identification and preliminary/outline design through to project completion and whole-life management.

**2.3 Increase the availability and use of supplier-led initiatives enabling damaged, excess and end of life materials and products to be returned for reuse, remanufacture or recycling.**

Product stewardship aims to reduce a product's environmental impact by 'stewarding' it throughout its lifecycle, to prevent it becoming pollution or landfill. This often involves manufacturers or suppliers providing 'take back' options.

Without a product stewardship scheme, responsibility for the waste is passed on to the site team. Increasing the availability and use of product stewardship schemes will reduce the volume of materials wasted and impact the design of products.

## 2.1 Change mindsets by improving awareness of and commitment to addressing, accounting for and improving environmental outcomes.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 2.1.1 | Establish an education programme for clients to learn about the value of, and how to ask for, improved environmental performance in construction work [7]. | Industry associations, industry stakeholders, NGOs | ✓ | 2024 - 2025 |
| 2.1.2 | Communicate benefits (e.g. cost savings) of waste reduction in the sector. | Industry stakeholders | ✓ | Ongoing |

## 2.2 Use procurement and contracting to minimise waste.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 2.2.1 | Template clauses encouraging circular principles in procurement available to use in contracts. | Industry stakeholders, NGOs | ✓ | 2024 |
| 2.2.2 | Best practice guide for procurement that recognises design costs/value of waste reduction. | Industry stakeholders, NGOs | | 2024 - 2025 |

## 2.3 Increase the availability and use of supplier-led initiatives enabling damaged, excess and end of life materials and products to be returned for reuse, remanufacture or recycling.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 2.3.1 | Create guidance for suppliers and manufacturers of construction products and materials looking to implement product stewardship schemes. Best practice guide for procurement that recognises design costs/ value of waste reduction. | Industry stakeholders, NGOs | ✓ | 2024 |
| 2.3.2 | Identify current product stewardship schemes available in the construction sector and collate these on an accessible online platform. | Industry stakeholders, industry associations, NGOs | | 2024 - 2025 |
| 2.3.3 | Connect providers with the intention of collaborating to achieve economies of scale and synergies across various product stewardship schemes e.g. shared transport or processing facilities. | Industry stakeholders, industry associations, NGOs | | Ongoing<br>2025 - 2030 |

INTERVENTION POINT 03

# Business models

Circular business models go beyond just reducing waste. They catalyse a fundamental shift in our approach to construction by realigning incentives for businesses to inherently prioritise circular economy outcomes, shaping how companies operate and generate value within the industry.

## Why?

Through models like product-as-a-service or build-to-lease, producers become stewards of their products. This means they have a vested interest in designing for disassembly, using high-quality, recyclable materials and ensuring the product's longevity. Maximising the asset's value throughout its lifecycle becomes the priority, not just selling it and moving on. This focus on long-term value creation fosters innovation in areas like modular construction and take-back programmes.

### 3.1 Support pilot projects and initiatives to test and scale alternative circular business models.

There are already a number of circular business models in the construction sector in Aotearoa New Zealand. Not only do these business models help reduce construction and demolition waste, they often cut long-term costs:

***Product as a Service (PaaS)***

PaaS is the concept of selling services and outcomes a product can provide rather than the product itself. Because the supplier maintains ownership, the PaaS model encourages the supplier to maximise the value of the asset across its life cycle, including the end of its life. Increasing the availability of PaaS business models will require partnerships between product manufacturers, service providers and end-users. There may be a need to pilot PaaS offerings in various sectors and develop standardised contracts and agreements outlining terms of service, pricing models and responsibilities for all parties involved.

***Material exchange platforms***

Material exchange platforms help reduce the need for new products and materials, while keeping valuable materials out of landfill. There are multiple material exchange platforms for construction materials available in Aotearoa New Zealand. Awareness and use of these platforms must increase. Industry stakeholders need to collaborate to promote their adoption and use.

***Reuse centres***

Where the Building Code permits, maximising product and material reuse makes financial sense for businesses. Reuse also helps promote the need to design and use products and materials that are more robust and last longer. There are a number of reuse centres for building materials in Aotearoa New Zealand. Expanding this network will result in accessible second-hand building materials and options for materials that may otherwise be sent to landfill.

***Offsite manufacturing***

Offsite manufacturing and other modern methods of construction can minimise waste, optimise material use and enable efficient onsite assembly. These methods improve on traditional onsite construction methods in controlled offsite environments. This means that processes for ordering and cutting materials to size are much more controlled, reducing material waste onsite due to offcuts. Waste collection, sorting and recycling are also easier to control, resulting in reduced waste to landfill [8]. One of the most commonly cited benefits of offsite manufacturing is "speed of construction" [9].

## 3.1 Support pilot projects and initiatives to test and scale alternative circular business models.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 3.1.1 | Establish new, and direct to existing, sources of funding e.g. grants and preferential business loans. | Industry associations, industry stakeholders, government, NGOs | ✓ | Ongoing<br>2024 - 2030 |
| 3.1.2 | Connect entrepreneurs to capable business advisors with experience of new business models to improve technical knowledge. | Industry associations | ✓ | Ongoing<br>2024 - 2030 |
| 3.1.3 | Facilitate collaboration and knowledge sharing among stakeholders, including industry partners, government agencies, research institutions and community organisations. | Industry stakeholders, government agencies, research institutions, community organisations | | Ongoing<br>2025 - 2030 |
| 3.1.4 | Profile successful pilots via developing and publishing case studies. | Those taking part in pilots, industry associations | ✓ | Ongoing<br>2024 - 2030 |
| 3.1.5 | Implement monitoring and evaluation mechanisms to assess the performance, impact and scalability of pilot projects, providing valuable insights for future initiatives. | Those taking part in pilots, industry associations, research agencies | | Ongoing<br>2025 - 2030 |

INTERVENTION POINT 04

# Onsite operations

Circular business models go beyond just reducing waste. They catalyse a fundamental shift in our approach to construction by realigning incentives for businesses to inherently prioritise circular economy outcomes, shaping how companies operate and generate value within the industry.

## Why?

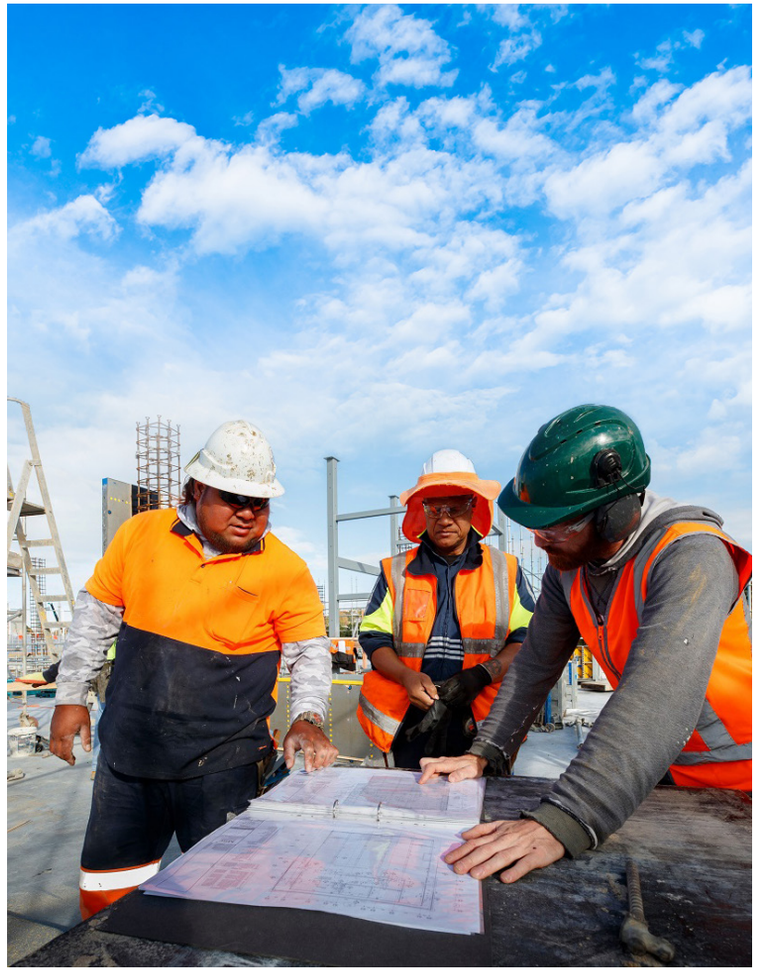
There are crucial actions that must happen onsite to ensure valuable materials are not sent to landfill. It is important that onsite staff are supported, enabled and encouraged to carry out these actions safely and correctly.

### 4.1 Ensure onsite operations effectively support waste reduction efforts across the value chain.

Effective onsite operations can ensure the success of waste reduction efforts. Accurate quantity surveying of materials ensures that excess materials are not purchased or brought to site, saving money and reducing waste. Contractors and subcontractors must be aware of waste minimisation goals and the actions required. This includes relevant product stewardship schemes and the correct storage of material and waste separation. There must also be sufficient facilities onsite to carry out these actions.

Effective site monitoring and reporting should be carried out to monitor waste and track progress towards waste reduction goals. This data should be used to identify areas for improvement, and be shared with industry stakeholders to improve sector performance.

Contractors can provide extremely useful insights to improve waste reduction. They are well placed to collaborate with suppliers to identify ways to reduce packaging waste, explore options for returning unused or damaged materials and design out waste. This includes sharing barriers as well as opportunities from an onsite perspective.



## 4.1 Ensure onsite operations effectively support waste reduction efforts across the value chain.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 4.1.1 | Encourage accurate quantity surveying to ensure optimum utilisation of materials i.e. discourage over ordering of materials. | Industry stakeholders (client, quantity surveyors, architect) | ✓ | Ongoing 2024 - 2030 |
| 4.1.2 | Provide adequate facilities to ensure waste is properly separated and stored onsite. | Industry stakeholders (client, quantity surveyors, architect) | ✓ | Ongoing 2024 - 2030 |
| 4.1.3 | Educate and engage contractors to ensure that waste reduction goals are met. | Industry stakeholders (clients, suppliers, manufacturers, architects, contractors) | ✓ | Ongoing 2024 - 2030 |
| 4.1.4 | Effective site monitoring and reporting to monitor waste and track progress towards waste reduction goals. Use and share data to identify areas for improvement. | Industry stakeholders (contractors, clients), industry associations | ✓ | Ongoing 2024 - 2030 |
| 4.1.5 | Collaborate with suppliers to reduce packaging waste, explore options for returning unused or damaged materials and ways that waste could be designed out. | Industry stakeholders (contractors, suppliers, manufacturers) | ✓ | Ongoing 2024 - 2030 |

INTERVENTION POINT 05

# Infrastructure

This includes such things as reprocessing and recycling facilities, as well as the infrastructure for reverse logistics. Combined with the associated information technology, reverse logistics enables the redistribution of materials to where they can be processed or reused at the end of life.

## Why?

Access to infrastructure that enables the reprocessing and redistribution of materials is a fundamental requirement for the transition to a low emissions circular economy. This includes hard infrastructure, such as reprocessing plants. It also includes logistics options as well as soft infrastructure, such as data capture (see Intervention Point 06).

Establishing a circular construction economy requires a rethink of our current waste infrastructure so products and materials can be reused, remanufactured and recycled. Aotearoa New Zealand has a relatively small, dispersed population. This presents additional challenges in scaling the right infrastructure and ensuring a steady flow of processable resources.

Currently, organisations operating circular business models are often required to meet additional costs of collection and reprocessing not faced by their linear 'take, make, waste' competitors. Instead, the 'take, make, waste' approach passes significant costs (or 'externalities') on to the wider community. This provides perverse financial incentives to stick with an unsustainable status quo.

### 5.1 Perform a nationwide, publicly available stocktake of construction and demolition waste solutions.

Progress on tackling these issues is hindered by the fact that the existing information about construction and demolition waste and how to deal with it is scarce and held in a variety of places.

### 5.2 Develop new reprocessing and recycling facilities.

Regional gaps in reprocessing and recycling facilities mean valuable materials are either not kept in circulation, or are transported long distances to reach appropriate facilities. A more coherent network of facilities would require fewer truck movements and make reprocessing and recycling more accessible and cost effective. More recycling facilities can provide a steady supply of locally sourced recycled materials for construction, reducing reliance on imported materials and enhancing supply chain resilience. New regional facilities would also create local jobs.

### 5.3 Improve reverse logistics systems for recovering materials.

Onsite waste can be created during the build, maintenance or at end-of-life. These materials could often be reused, repurposed or recycled. However, there are limited collection and transport options to move these secondary materials efficiently. This often results in these materials going to landfill.

### 5.4 Develop accurate baseline measurements for waste diversion and generation in construction.

Good data makes for realistic targets, appropriate policy and workable plans. Some targets are based on the amount of generated waste that is diverted from landfill. However, it is more impactful to reduce the amount of waste generated in the first place. This is often measured as the amount of waste generated per square metre.

### 5.5 Develop and support local networks to foster knowledge sharing and collaboration to reduce waste.

This could include providing a forum to reduce isolation for progressive practitioners and a connection point to national activity.

### 5.6 Improve data collection and sharing.

Public data on material flows in recycling and waste volumes at a national level is extremely limited and often lacks detail. Even rarer is data that helps us to value solutions such as reuse, remanufacturing and repair.

Measuring the type and amount of materials we use and discard is a prerequisite for appropriate management and monitoring. It is also vital to helping us make evidence-informed decisions around where we direct resources to improve our use and management of materials, and to track effectiveness.

Access to accurate digitised data is essential to ensuring that new technologies operate effectively. Now is a critical time to initiate the collection of high-quality data on materials to better understand the baseline. That will show us where we can improve. It will also inform practical and meaningful decisions in the short-term.

### 5.1 Perform a nationwide, publicly available stocktake of construction and demolition waste solutions.

| | Goals and actions | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.1.1 | Sector-wide online list published where materials and products can be reprocessed or recycled. | Industry stakeholders (manufacturers), industry associations, recycling facilities, reuse and remanufacture partners | | |
| 5.1.2 | Profile sector-wide platform/s for sharing waste materials/resources to drive usage:<br>a. Regional hubs<br>b. Satellite hubs for storage | Regional Councils, industry stakeholders, reuse and remanufacture partners | ✓ | |
| 5.1.3 | Improve collaboration and coordination between regions. | Regional Councils, industry stakeholders. | ✓ | |

### 5.2 Develop new reprocessing and recycling facilities across New Zealand.

| | Goals and actions | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.2.1 | Waste Minimisation Funding contributes to the capital costs of establishment. | Regional councils, government | ✓ | |
| 5.2.2 | Gaps in regions for such facilities are filled. | Regional councils, government | | |

## 5.3 Improve reverse logistics systems for recovering materials.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.3.1 | Establish a pilot to test a system for aggregating current return systems and reducing the 'friction' associated with onsite pick up. | Regional councils, industry associations, industry stakeholders | ✓ | 2024 - 2025 |

## 5.4 Develop accurate baseline measurements for waste diversion and generation in construction.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.4.1 | Establish current levels of waste diversion and generation data per key material category as a baseline. | Government | ✓ | 2024 |
| 5.4.2 | Set national reduction targets that cascade through individual organisations and projects to drive action. | Government | | 2024 - 2026 |

## 5.5 Develop local networks to foster knowledge sharing and collaboration to reduce waste.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.5.1 | Replicate the models in areas such as Auckland and the Hawkes Bay to establish local networks across the country and establish a mechanism for sharing and collaborating across them. | Regional councils, industry associations, industry stakeholders | ✓ | 2024 - 2025 |

## 5.6 Improve data collection and sharing.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 5.6.1 | Develop an information gap analysis across the value chain. | NGOs, government, industry associations | ✓ | 2024 - 2025 |
| 5.6.2 | Do a comparative exercise of what other countries and industries are doing in this space. | NGOs, government, industry associations | ✓ | 2024 - 2025 |

INTERVENTION POINT 06

# Technology and modern methods of construction

Technology and modern methods of construction are key enablers for circular outcomes. Enabling technology and modern methods of construction include ‘material passports’, where materials can be tracked throughout their life to enable greater reuse, 3D printing of structures, digital modelling, offsite manufacturing and artificial intelligence (AI) to predict maintenance requirements ahead of failures.

## Why?

Technology can increase efficiency and productivity and will help the shift to a circular economy. The marriage of physical and digital technology is enabling a technological revolution that is fundamentally altering the way we design, construct and maintain buildings and infrastructure.

### 6.1 Embrace new technologies to enable circular construction.

In the construction sector, emerging technologies are demonstrating how technology can help reduce waste across the value chain. Such technologies can optimise the collection and use of data about a product or building throughout its lifecycle [10].

***Blockchain technology***

Blockchain is a decentralised and secure digital ledger for recording transactions. Blockchain technology can track materials across their life cycle providing end-to-end traceability. This enables confidence in the transparency and authenticity of where materials come from, which in turn can increase rates of recovery.

***Digital twins***

A digital twin is “a dynamic and interconnected digital representation of a physical asset or system, enabling comprehensive insights and informed decision making” [11]. Digital twins can synchronise data between physical and digital realms fostering a two-way data flow. Using this data to monitor, analyse and report on a product or building can help:

- Identify products and components that require maintenance or replacement, including their location, material makeup and relationship with other products or materials.
- Simulate assembly and disassembly before physical work begins, allowing unnecessary waste creation to be predicted and designed out.
- Identify elements of existing assets that could be reused or recycled.
- Use operational data to inform and improve future buildings.
- Resolve key barriers relating to market inefficiencies, such as incomplete information on product and material composition [12].

Digital twins can also be used across the value chain. They can help with:

- The planning phase, by informing land-use assessment.
- Design development, by providing important contextual information on the location and monitoring potential environmental and social impacts.
- Logistics and reverse logistics, by planning and monitoring deliveries and pickups, as well as associated greenhouse gas emissions [13].

### *Material passports*

Material passports provide an inventory of the products, materials and components that make up a building. The database of these passports can track items throughout their lives and provide data on origin, composition, repair and end-of-life options [14]. Using Material passports enables the collection, use and sharing of data. They also promote end-of-life planning for reuse and recycling and ensure knowledge shared throughout the lifecycle of a building.

### *Artificial Intelligence (AI)*

AI integration could enable other technologies, such as digital twins, to accurately predict when building products and components will need maintenance. AI also has the potential in predictive modelling, complex data analysis and anomaly detection [15].

**These technologies can assist in creating circular economy initiatives and save money and resources. A number are already in use in the construction and demolition sector [16].**

**6.1 Scale available new technologies to enable circular construction.**

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 6.1.1 | Profile learnings and benefits achieved from projects using emerging technologies across the sector. | Industry stakeholders, industry associations | ✓ | Ongoing 2024 - 2030 |
| 6.1.2 | Foster research and development in relevant technologies. | Research agencies, educational institutions, industry stakeholders, government | ✓ | Ongoing 2024 - 2030 |
| 6.1.3 | Direct funding and support to pilot projects testing new technology in the real world. | Government, regional councils, industry stakeholders | | 2024 - 2025 |
| 6.1.4 | Establish partnerships with technology companies and research institutions to leverage expertise and resources in advancing circular technology solutions. | Research agencies, technology companies, industry stakeholders | | 2024 - 2025 |

INTERVENTION POINT 07

# Legislation and incentives

Appropriate incentives and disincentives are required at a legislative level to drive mainstream change.

## Why?

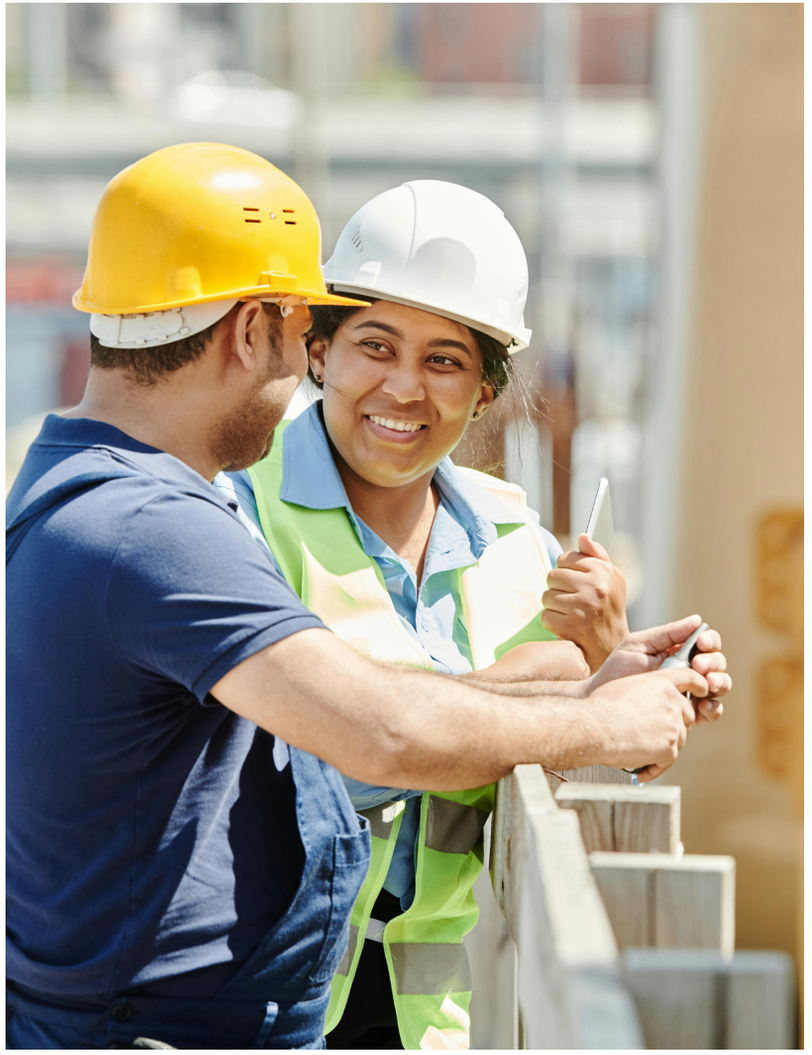
Policy and legislation set rules that can enable a circular economy. Appropriate incentives and disincentives are required, as well as a coordinated and bold government approach. Detailed policy recommendations are, however, outside the scope of this Implementation Plan.

To remain competitive, businesses need to tune into and start adapting to signals from government - and consumers. Disposing of waste will become more expensive. Taking responsibility for goods will become increasingly regulated, both in Aotearoa New Zealand and in export markets.

**7.1 Incentivise and align legislation to facilitate circular construction practices [17].**

This includes:

- working with banks and other stakeholders to improve financial incentives for reducing construction waste
- collaborating with industry associations and advocacy groups to develop legislative measures that support a thriving circular construction sector e.g. extended producer responsibility and tax incentives to promote circularity
- collectively advocate for legislative changes that support the reduction of C&D waste



## 7.1 Incentivise and align legislation to ensure environmentally sustainable business practices are facilitated.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 7.1.1 | Carry out a stock take of the full regulatory and policy spectrum to ensure the construction sector is supported to deliver an environmentally sustainable built environment. From this ensure that:<br>a. Policy and regulatory needs and barriers/disincentives/gaps across the construction value chain that influence environmentally sustainable performance are identified<br>b. Policies and regulations are improved to provide better cohesion, clarity and consistency, reflect whole-of-life environmental performance and enable innovative practices [18]. | Government, NGOs, industry associations, industry stakeholders | ✓ | 2024 - 2025 |
| 7.1.2 | Identify what economic and financial measures are needed to support the sector to lift environmentally sustainable performance by:<br>a. Assessing options for use of existing economic measures<br>b. Examining existing financial tools and insurance drivers<br>c. Reviewing existing legal mechanisms<br>d. Identifying new financial and any other incentives that would accelerate improved environmentally sustainable practices [19]. | Government, NGOs, industry associations, industry stakeholders | ✓ | 2024 - 2026 |
| 7.1.3 | Work with banks and other stakeholders to improve financial incentives for reducing construction waste e.g. preferential loans associated with circular construction. | Financial institutions, government, industry stakeholders | ✓ | 2024 - 2026 |
| 7.1.4 | Collaborate with industry associations and advocacy groups to develop and advocate for legislative measures that support a thriving circular construction sector e.g. extended producer responsibility and tax incentives to promote circularity. | Industry associations, advocacy groups, government, industry stakeholders | ✓ | Ongoing<br>2024 - 2030 |

INTERVENTION POINT 08

# Learning and knowledge sharing

A comprehensive learning framework is needed covering all aspects of building out waste and material use maximisation.

## Why?

There is a lack of knowledge and training on designing out waste and on-site waste management. Waste reduction is not routinely taught in construction. Educational resources would help the sector develop standardised best practice processes of designing out, reducing, managing and diverting waste.

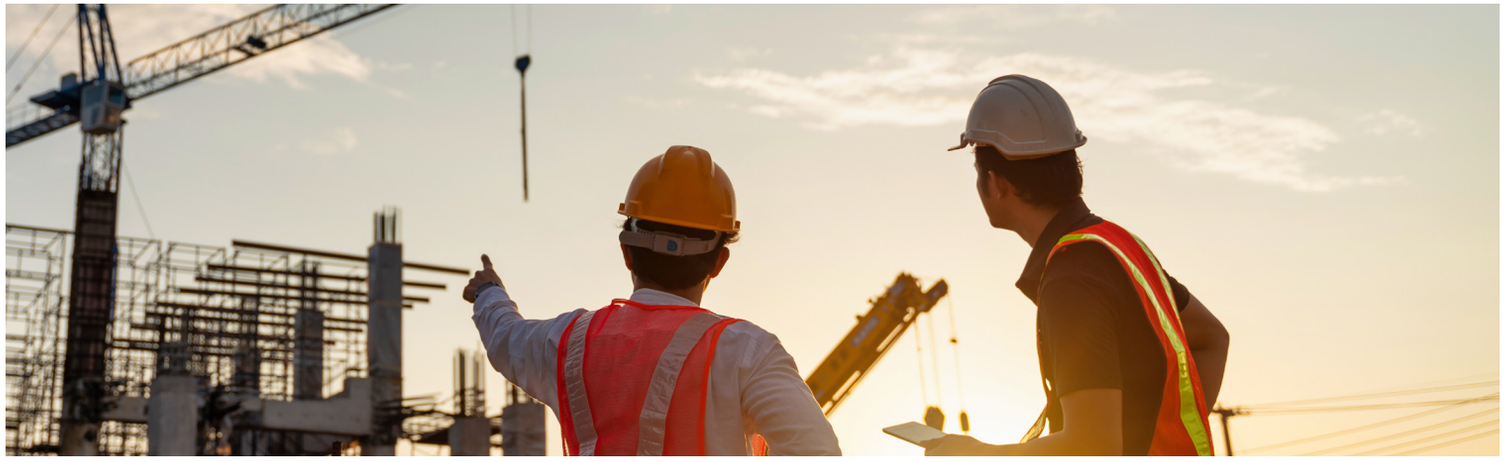
**8.1 Provide accessible waste knowledge throughout the construction process of all construction projects.**

By sharing success stories, questions and hurdles, industry can work together to reduce waste and use less resources.

**8.2 Support education to reduce construction waste.**

Education is a key component of changing mindsets and behaviour. BRANZ states that all workers on the site should “be committed to the overall waste minimisation programme and have a sense of ownership of the waste management” and “undergo training required to become familiar with the requirements of the programme” [20]. Creating accessible resources and affordable qualifications that focus on sustainability in construction will result in better behaviours and practices that will reduce waste. For example, Naylor Love has introduced a Resource Sorter qualification. This micro-credential is worth 5 credits with the New Zealand Qualifications Authority.

Designing out waste should be fully embedded into architectural and engineering qualifications as well as industry association educational offerings - not just as side topics or optional studies. Tertiary level research has already given us important information relating to construction waste and how we can reduce it. These programmes should be supported by industry associations and the private sector to improve our collective knowledge.



## 8.1 Provide accessible waste knowledge throughout the construction process of all construction projects.

| Goals and actions | | Potential partners/support organisations | Start now | Timeframe |
|---|---|---|---|---|
| 8.1.1 | Collaborate to collect existing knowledge of waste reduction techniques and frameworks and collate findings. | Industry stakeholders, industry associations | ✓ | Ongoing 2024 - 2030 |
| 8.1.2 | Create an Information Hub - a centralised information site about all aspects of construction waste. | Industry stakeholders, industry associations, NGOs | ✓ | 2024 - 2026 |
| 8.1.3 | Develop and use a standard language for a circular construction economy. | Industry stakeholders, industry associations, NGOs | ✓ | 2024 |

## 8.2 Support education to reduce construction waste.

| Goals and actions | | Potential partners/support organisations | | Timeframe |
|---|---|---|---|---|
| 8.2.1 | Work with educational institutions to include waste in construction-related (architecture, design, engineering etc) qualifications. | Educational institutions, industry associations | ✓ | Ongoing 2024 - 2030 |
| | Work with industry to develop effective onsite training resources and qualifications relating to waste reduction. | Industry associations, industry stakeholders | ✓ | 2024 - 2026 |
| | Support tertiary level research programmes that focus on reducing construction waste. | Educational institutions, industry associations | ✓ | Ongoing 2024 - 2030 |

# Looking ahead

## What does a truly circular future look like for the construction sector?

A circular future for the construction sector is one where industry collaboration and innovation has enabled a radical rethink of the traditional construction value chain. The ability to repurpose or reuse materials is considered at the design stage.

Owners, developers, designers and builders will consider a project's end-of-life and material use at its concept, then work through how to build, procure and design to maximise a material's lifecycle and avoid waste. Existing and recycled materials will be available, allowable, accessible and preferred over virgin sources. Any excess or damaged materials will have predesignated usage streams which are easily accessible and can be engaged with digitally. These resource streams will be developed and maintained by suppliers acting as responsible stewards of their products throughout the lifecycle. Suppliers will provide options for pre-cut, or prefabricated components to prevent excess materials entering the supply chain. Materials will be tracked from usage to usage by their material passport.

We need circular principles to be as embedded in industry as health and safety. Circular best practice must be taught as a core part of the learning curriculum across all relevant disciplines. Waste elimination and maximising the value of materials should be a regular topic, from on-site team talks to industry conferences.

Ultimately, we see a world where problematic materials and packaging are no longer considered, where each material's use is maximised, where all materials are circular and there is no waste skip on site.

This implementation plan sets us on the right trajectory to achieving this future.

## Thanks to...

The Construction Sector Accord, workshop attendees, Action Group participants and the countless industry stakeholders who contributed to this Implementation Plan.

## Useful resources:

ARUP. Circular Buildings Toolkit.

Commerce Commission New Zealand. (2019). The Commerce Act: Product Stewardship Schemes.

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[13] NSW, Circular design guidelines for the built environment

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[18] Ibid.

[19] Ibid.

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CONSTRUCTION SECTOR ACCORD

# Industry-led Implementation Plan for Circular Construction

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