



# Environmental challenges, opportunities and transitions for construction in Aotearoa New Zealand

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# Foreword



A number of years ago, Malcolm Gladwell introduced the concept of 'tipping points' to explain how and why significant societal changes can suddenly occur. Gladwell defined a tipping point as "the moment of critical mass, the threshold, the boiling point."<sup>1</sup>

It seems to me that our society – globally, nationally and within the construction sector – has reached the tipping point about the urgency for climate action. Whatever sphere of life I am in, personal or professional, the people I talk to are motivated for change. I see this in those of all ages and stages of life. People and organisations are already adapting and making progress on climate action, and whether small or large, our actions speak louder than words. The response to the He Pou a Rangi | Climate Change Commission draft advice to government<sup>2</sup> is one example of people taking action. The Commission received over 15,500 submissions.

The desire to take meaningful climate and environmental action is evident within the construction sector. There is amazing work being done by industry organisations, architectural practices, building companies and clients to name a few. And there are even more wanting support and guidance on how to get started or take their current action to the next level.

Our sector makes a significant contribution to our country. The sector has been and will continue to be a significant employer and contributor to our economy. It is made up of people who are passionate about

the quality and the impact of the built environment that we create – a workforce who are renowned for solving difficult problems through innovation and ingenuity. As a sector, we have a history of being resourceful, clever and thoughtful to solve problems and generate new ideas. And we have the opportunity to take our ingenuity to the next level by collaborating to find solutions across the system.

The development of the Environment Workstream under the Construction Sector Accord is an important step towards harnessing the sector's potential to make a real contribution to Aotearoa's climate and environmental aspirations. This document places construction, its scale and contribution and the environmental challenges in the context of a broader system. It does this in a way that also sets out some of the opportunities for system-wide change and some of the transitions that might be needed.

This paper is a significant milestone in the journey to bring the sector together to develop a vision and roadmap to galvanise collective action across the construction sector. This work is not going to be easy, nor will it be short term. Addressing the challenges, opportunities and transitions will require collective leadership across the sector.

Your input is therefore very important. Don't leave this important work to others.

**Waiho i te toipoto, kua i te toiroa.**  
Let us keep close together, not wide apart.

Chelydra Percy  
Environment Workstream Lead, Construction Sector Accord  
Chief Executive, BRANZ

A handwritten signature in black ink, appearing to read 'Chelydra Percy'.

<sup>1</sup>Gladwell, M. (2000) *The tipping point: How little things can make a big difference*. Boston, MA: Little, Brown and Company.

<sup>2</sup><https://haveyoursay.climatecommission.govt.nz/comms-and-engagement/future-climate-action-for-aotearoa/>

# Purpose and approach

This paper informs the development of the Environment Workstream of the Construction Sector Accord's Transformation Plan.<sup>3</sup> The end point of this work is a roadmap for the construction sector to enhance environmental performance and meet Aotearoa New Zealand's climate and other environmental aspirations. The roadmap will outline a vision and the actions that will need to be taken over the short, medium and longer term to achieve that vision. It will identify the actions the Construction Sector Accord will drive and support and how this work will align with other work that is happening across the sector and within government, including the other workstreams of the Accord.

The paper synthesises research on trends and developments influencing the sector and insights gained from in-depth interviews with 14 leaders from across the Aotearoa New Zealand construction sector about the environmental issues the sector is facing. Relevant comments from these interviews have been included throughout this paper as quotes.

Seven important environmental challenges for the construction sector are identified. These challenges are:

- greenhouse gas emissions
- energy
- waste
- water
- land use
- climate adaptation
- regenerative construction.

The paper also highlights some of the responses emerging across the construction sector where there is potential to align with and catalyse change.

The paper does not provide solutions to the challenges identified in the work so far. Rather, it provides a way of thinking about these challenges in a broader context. It takes a systems perspective to illustrate important transitional tensions that still need to be resolved. It is intended to inform strategies for implementation that will be the focus of the next phase of the workstream development.

An expert advisory group will be convened to help develop the roadmap. The group will comprise of experts invited from public and private organisations in the construction sector who are working on sustainability, climate change or environment programmes. This will ensure that any actions identified as part of this work will be done in the knowledge of existing work under way and recognise the opportunities for alignment with that work.

As a key input into the workstream and to validate what has been done so far, we'd like feedback from the broader sector on these three aspects discussed in this paper:

- The seven environmental challenges identified.
- The characteristics of Aotearoa New Zealand's future construction sector to address these challenges.
- Opportunities to align with other work to enhance the environmental performance of the sector.



This feedback will be invaluable input to ensure the advisory group's work is robust and based on the current state of play of activities in the sector. We welcome feedback by 21 July 2021 via a short survey found at [branz.co.nz/about/construction-sector-accord](https://branz.co.nz/about/construction-sector-accord). There is an opportunity in the survey to provide further feedback, or please email [accord.environment@branz.co.nz](mailto:accord.environment@branz.co.nz) if you have any further contribution you would like to make.

Updates on the progress of this work will be given through the Accord news channels. Please sign up to receive these and other Accord updates through the Get Involved<sup>4</sup> section of the Accord website.

This paper was commissioned by BRANZ,<sup>5</sup> with sector interviews and issue identification undertaken by thinkstep-anz<sup>6</sup> and Catapult.<sup>7</sup> Additional research and analysis was provided by BRANZ and a synthesis done by Dr Robert Hickson of Day One Futures.<sup>8</sup> Funding for this work has been provided by BRANZ Inc through the Building Research Levy and from the Construction Sector Accord via the Ministry of Business, Innovation and Employment (MBIE).

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<sup>4</sup><https://www.constructionaccord.nz/get-involved/>

<sup>5</sup><https://www.branz.co.nz/>

<sup>6</sup><https://www.thinkstep-anz.com/>

<sup>7</sup><https://catapult.co.nz>

<sup>8</sup><https://www.dayonefutures.nz/>

# Contribution of construction to Aotearoa New Zealand

The building and construction sector<sup>9</sup> is an essential component of Aotearoa New Zealand's social and economic wellbeing. It is an important contributor to GDP and a substantial employer, as well as helping build and shape our society.

In 2020, the construction industry<sup>10</sup> had over 67,000 firms and employed about 225,000 people (Figure 1). The industry accounted for 6.9% (\$17 billion) of the national GDP.

It is dominated by small businesses, with nearly two-thirds of the firms being self-employed enterprises, and one-third employing fewer than 20 people. Most of the industry's profitability is generated by smaller firms (under 100 employees). Construction-related businesses accounted for 11.4% of total businesses in 2019, and before the COVID-19 pandemic, the sector's growth was more rapid than the economy's average.<sup>12</sup> The sector is also a means of delivering wider outcomes, including:

- good social connections and cohesion
- opportunities for learning and development
- cultural wellbeing
- economic development
- improved standards of living
- restoration and preservation of natural environments and accessibility of these.

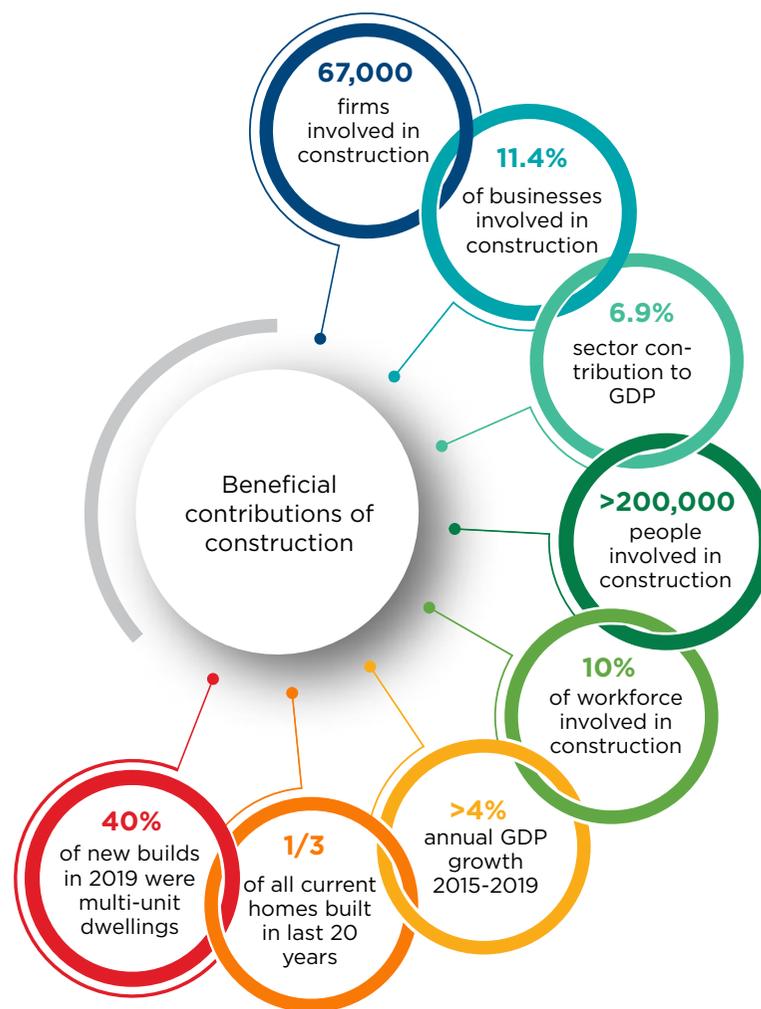


Figure 1. Beneficial contributions of construction to Aotearoa New Zealand.<sup>11</sup>

<sup>9</sup>The sector is defined as the full value chain of construction. This includes clients, planning and design, construction, material and logistics and the use of a building or infrastructure. It also includes related activities such as financing, legal and insurance services.

<sup>10</sup>Firms directly involved in the design, building, maintenance and repairing of buildings or infrastructure.

<sup>11</sup>Data sources: Deloitte. (2021). *A better way forward: Building the road to recovery together*. Construction Sector COVID-19 Recovery Study. Auckland: Deloitte. <https://infracom.govt.nz/assets/Uploads/Construction-Sector-Covid-19-Recovery-Study.pdf>; <https://www.mbie.govt.nz/dmsdocument/12220-construction-factsheet-october-2020>; <https://www.stats.govt.nz/reports/housing-in-aotearoa-2020>.

<sup>12</sup>Deloitte, 2021 (see footnote 11).

# Environmental challenges and opportunities

## Challenges

Alongside the benefits the construction industry provides, some of the sector's activities have created environmental problems, costs and some unintended negative consequences where broader outcomes are not always realised. The resulting impacts are a mix of those directly attributable to sector activities and others that are consequences of a broader range of factors (such as occupant behaviours). Some of these challenges are summarised in Figure 2.

There is widespread recognition that the sector needs to change, both in relation to environmental challenges and broader performance issues the sector is facing.

Based on interviews with industry leaders and research into national and international trends, we have identified seven key environmental challenges for the construction sector. These relate to the construction process as well as to the use of buildings over their lifetimes.

**“You can't just keep training people to build in the way we have been building for the last few decades.”**

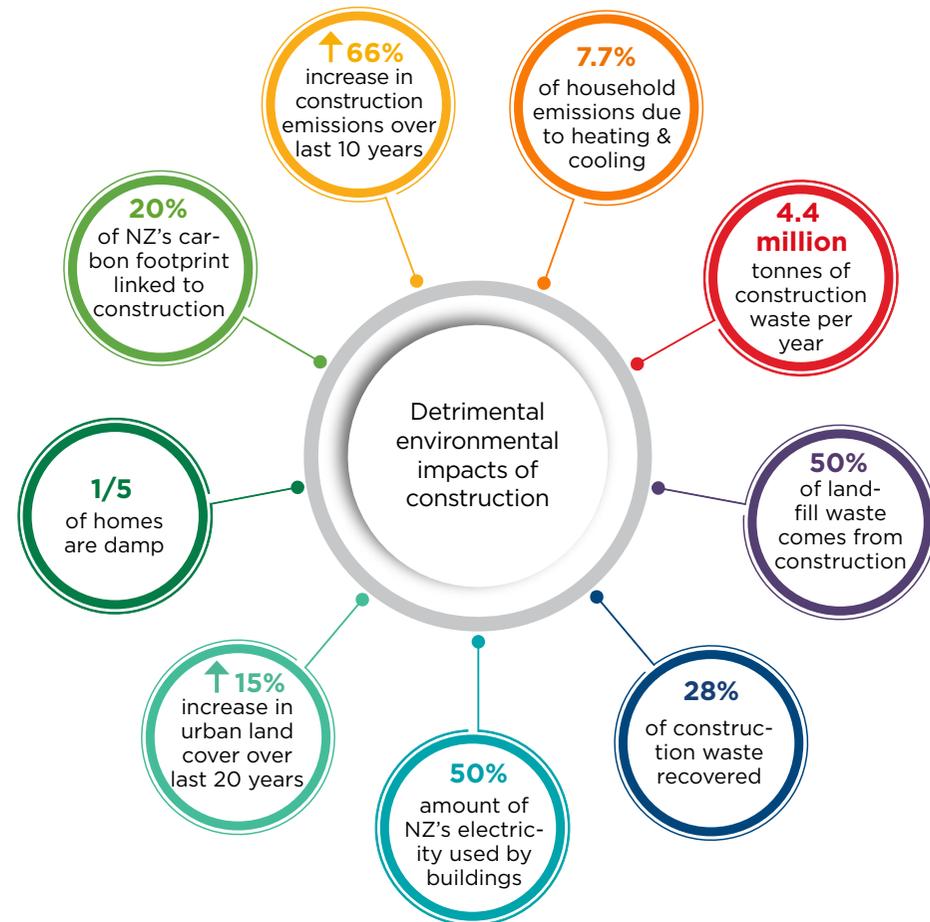


Figure 2. Detrimental environmental impacts related to construction in Aotearoa New Zealand.<sup>13</sup>

<sup>13</sup>Data sources: Vickers, J. & Fisher, B. (2018). *The carbon footprint of New Zealand's built environment: Hotspot or not?* Wellington: thinkstep-anz. <https://www.thinkstep-anz.com/resrc/reports/the-carbon-footprint-of-new-zealands-built-environment/>; Wilson, D., Chowdhury, T., Elliott, T., Elliott, L. & Hogg, D. (2017). *The New Zealand Waste Disposal Levy: Potential impacts of adjustments to the current levy rate and structure*. Auckland: Eumonia Research & Consulting. <https://eumonia.co.nz/waste-disposal-levy-research/>; MBIE. (2020a). *Energy in New Zealand 2020*. Wellington: Ministry of Business, Innovation and Employment. <https://www.mbie.govt.nz/dmsdocument/11679-energy-in-new-zealand-2020>; Ministry for the Environment & Stats NZ. (2021). *Our land 2021*. Wellington: Ministry for the Environment & Stats NZ. <https://environment.govt.nz/assets/Publications/our-land-2021.pdf>; <https://www.stats.govt.nz/news/one-in-five-homes-damp>.



## Greenhouse gas emissions

The built environment<sup>14</sup> accounts for around 20% of Aotearoa New Zealand's carbon emissions.<sup>15</sup> This is through the materials used in construction, transport-related emissions from construction and the energy used to construct and operate buildings. About half the greenhouse gas emissions associated with buildings in Aotearoa New Zealand are estimated to come from embedded emissions in the materials. Most of the rest come from operational emissions (mostly heating and cooling) over the building's life. A small proportion is derived from building waste.<sup>16</sup>

Household emissions are increasing, mostly due to transport, but fuels for heating and refrigerants for cooling make up 7.7% of household emissions.<sup>17</sup>

The Climate Change Response (Zero Carbon) Amendment Act 2019 has set a target for Aotearoa New Zealand to reduce net emissions to zero by 2050. The Ministry for Business, Innovation and Employment's Building for Climate Change programme<sup>18</sup> identified the need to reduce emissions both during construction and over the lifetime of the building. It identifies the challenges to this, including lack of methods and standards and the costs associated with emission reduction. If the proposed Whole-of-Life Embodied Carbon Emissions Reduction Framework<sup>19</sup> is adopted, there would be caps on embodied greenhouse gas emissions per square metre of floor area for new buildings. Likewise, the Transforming Operational Efficiency Framework proposes caps on operational emissions of new buildings.<sup>20</sup>

The seven key environmental challenges are summarised in Figure 3.

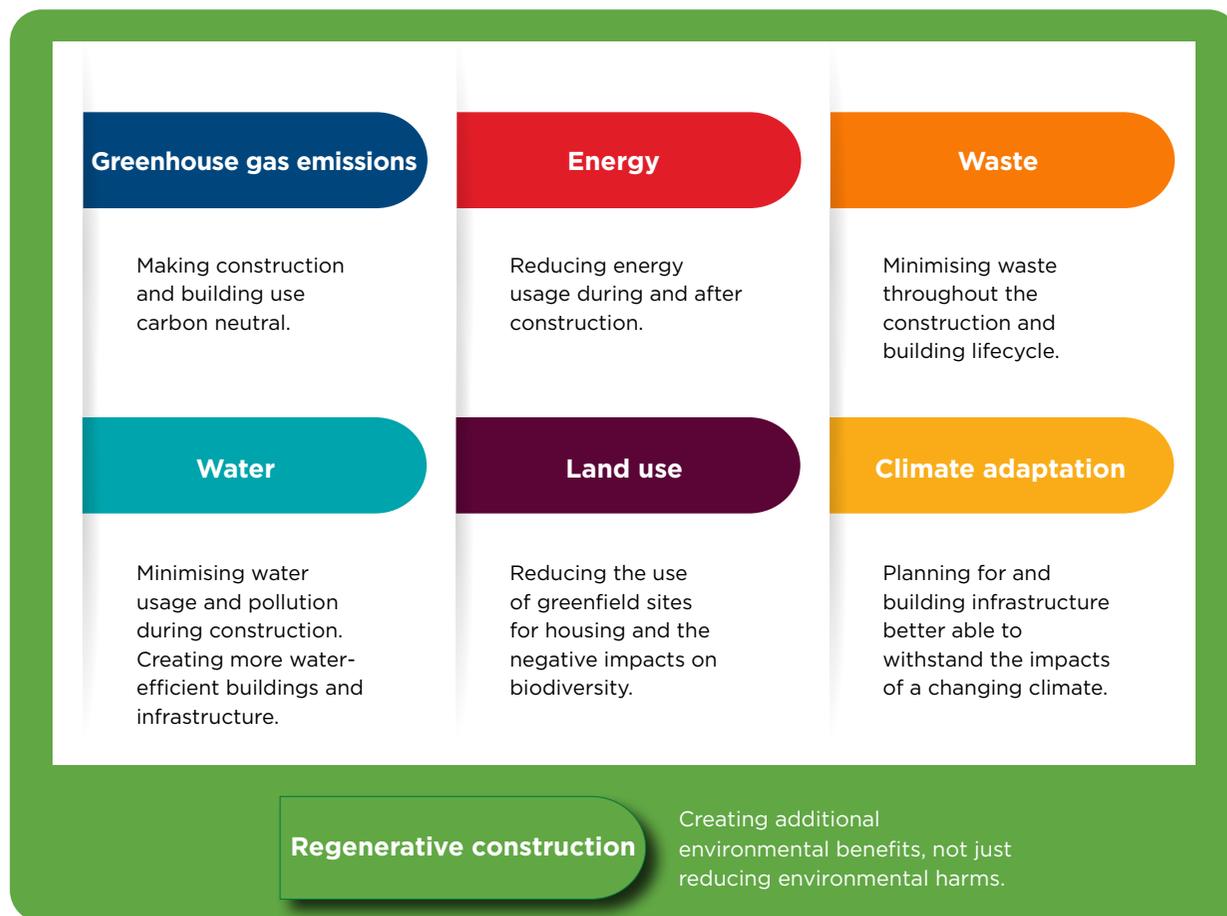


Figure 3. Seven environmental challenges for the construction sector.

<sup>14</sup>The built environment encompasses places and spaces created or modified by people including buildings, parks and transportation systems.

<sup>15</sup>MBIE. (2020b). *Transforming operational efficiency*. Wellington: Ministry of Business, Innovation and Employment. <https://www.mbie.govt.nz/dmsdocument/11793-transforming-operational-efficiency>

<sup>16</sup>Vickers & Fisher, 2018 (see footnote 13).

<sup>17</sup><https://www.stats.govt.nz/news/new-report-shows-household-emissions-increasing>

<sup>18</sup><https://www.mbie.govt.nz/building-and-energy/building/building-for-climate-change/>

<sup>19</sup>MBIE. (2020c). *Whole-of-Life Embodied Carbon Emissions Reduction Framework*. Wellington: Ministry of Business, Innovation and Employment. <https://www.mbie.govt.nz/dmsdocument/11794-whole-of-life-embodied-carbon-emissions-reduction-framework>

<sup>20</sup>MBIE, 2020b (see footnote 15).



## Energy

The construction sector is energy intensive. Recent data is not available, but in 2012 it was estimated that the construction sector used about 5% of Aotearoa New Zealand's energy, with the industry heavily dependent on petroleum fuels.<sup>21</sup>

Energy usage is closely associated with greenhouse gas emissions. While most of Aotearoa New Zealand's electricity sources are already renewable, improving energy efficiency across the construction industry and in buildings will further help reduce carbon emissions.

Around 65–70% of the energy consumed in buildings is in the form of electricity, and buildings use slightly more than half of the electricity produced in Aotearoa New Zealand. The Transforming Operational Efficiency Framework proposes requirements on energy use in new buildings.<sup>22</sup>

## Waste

Construction and demolition activities are estimated to generate 4.4 million tonnes of waste annually,<sup>23</sup> and BRANZ estimates that this may represent up to 50% of Aotearoa New Zealand's total waste going to landfills,<sup>24</sup> the majority of which (80%) goes to cleanfills. Waste is a significant cause of concern within the sector, with 46% of respondents in a recent survey indicating that they were working on waste reduction initiatives.<sup>25</sup>

Waste contributes directly and indirectly to greenhouse gas emissions, causes pollution to land, air and water, and affects land use. It also imposes economic costs, as well as adversely affecting the quality of life for people near waste sites and creating hazards for workers on building and waste disposal sites.<sup>26</sup>

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<sup>21</sup>Isaacs, N. (2012). Energy efficiency needed in construction sector. *Build*, 128, 32–33. <https://www.buildmagazine.org.nz/assets/PDF/Build128-32-Energy-Efficiency-Needed-In-Construction-Sector.pdf>

<sup>22</sup>MBIE, 2020b (see footnote 15).

<sup>23</sup>Wilson et al., 2017 (see footnote 13).

<sup>24</sup><https://www.branz.co.nz/sustainable-building/reducing-building-waste/>

<sup>25</sup>Colmar Brunton. (2020). *Construction Industry Survey 2020*. Wellington & Auckland: Civil Contractors New Zealand (CCNZ) & Teletrac Navman. [https://civilcontractors.co.nz/files/cust/CMS/Documents/2020%20Construction%20Industry%20Survey\\_compressed.pdf](https://civilcontractors.co.nz/files/cust/CMS/Documents/2020%20Construction%20Industry%20Survey_compressed.pdf)

<sup>26</sup>Deloitte, 2021 (see footnote 11); <https://www.branz.co.nz/sustainable-building/reducing-building-waste/>

There are lost opportunities from waste. In 2015, it was estimated that only 28% of waste from the construction sector was recovered, and Aotearoa New Zealand's performance in resource and waste recovery was poor compared to some other countries.<sup>27</sup> To date, with the low cost of disposal for much of the material used in construction, there have not been strong incentives to recover waste building materials. The Ministry for the Environment is developing a new waste strategy for Aotearoa New Zealand that will set the direction and guide investment to address waste and resource recovery challenges over the coming decades.<sup>28</sup> This may be an important driver to shift views on opportunities for greater waste recovery.

## Water

Water is an important environmental issue for the sector because of how construction and building use may impact water availability and affect water quality.

Considerable (but unquantified) amounts of potable water are used during construction and during the life of buildings. Similar amounts of wastewater also come from construction and building use. The provision, treatment and transport of water contributes indirectly to greenhouse gas emissions, mainly through the use of electricity.

Water supply is already under pressure in parts of Aotearoa New Zealand, and increasing water scarcity is predicted due to impacts from a changing climate. Water quality is already an issue, and increasing regulatory oversight of freshwater is anticipated.<sup>29</sup> Population growth in some areas such as Auckland is also impacting demands. Improving the efficiency of water use during construction, along with better building and urban design can help reduce demands and usage and contribute to improved management of rainfall and wastewater. The Transforming Operational Efficiency Framework proposes requirements on water use in new buildings.<sup>30</sup>

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<sup>27</sup>Wilson et al., 2017 (see footnote 15).

<sup>28</sup><https://environment.govt.nz/what-government-is-doing/areas-of-work/waste/national-waste-strategy-under-development/>

<sup>29</sup><https://environment.govt.nz/what-government-is-doing/areas-of-work/freshwater/e/freshwater-reform/>

<sup>30</sup>MBIE, 2020b (see footnote 15).



It is well recognised that water capacity and resilience will be an increasing problem over coming decades without urgent action. This is due in part to rapid urban growth and under-investment in maintenance of water infrastructure (such as pipes and treatment stations). A focus of the Three Waters Reform Programme<sup>31</sup> is to address the challenge of replacing ageing water infrastructure or fund and manage new infrastructure.

## Land use

In Aotearoa New Zealand, urban areas have tended to sprawl rather than intensify or grow upwards. That is starting to change, but increasing demand for housing is still putting pressure on creating more greenfield sites. Urban expansion can come at the cost of consuming or fragmenting productive farmland or other green spaces.

The area of urban land in Aotearoa New Zealand increased by 15% between 1996 and 2018.<sup>32</sup> During this century, there has been a 54% increase in highly productive agricultural land being converted to housing.<sup>33</sup>

The impact of built environments on native biodiversity is also a recognised issue. Urban expansion along with farming have contributed to habitat loss and species decline.<sup>34</sup>

Current changes to resource management legislation and regulations are intended, in part, to provide greater protections to the environment.

The draft National Policy Statement on Indigenous Biodiversity requires territorial authorities to identify and map Significant Natural Areas, which may affect land use decisions.<sup>35</sup>

**“We have somewhat locked ourselves into a mode of construction centred around urban sprawl and large centralised infrastructure.”**

## Climate adaptation

While some natural hazards (such as earthquakes) are recognised by building and infrastructure codes and standards, resilience to emerging risks such as climate change impacts are not yet well accounted for. These risks include flooding and extreme weather, saltwater intrusion into groundwater and risks to sea-level exposed infrastructure such as roads and ports.<sup>36</sup>

Designing in robustness to account for such risks (such as stronger foundations and walls or increased water management capacity) has economic and environmental costs. These costs include increased emissions that may worsen climate change or additional environmental degradation.

Nature-based solutions<sup>37</sup> and improved designs that prioritise working with the environment rather than seeking to control it, help improve resilience to climate change impacts. So too does better decision making about where not to build.

**“We need to be planning for adaptability in the future.”**

<sup>31</sup><https://www.dia.govt.nz/Three-Waters-Reform-Programme>

<sup>32</sup><https://www.stats.govt.nz/indicators/urban-land-cover>

<sup>33</sup>Ministry for the Environment & Stats NZ, 2021 (see footnote 13).

<sup>34</sup>Ministry for the Environment & Stats NZ. (2019). *Environment Aotearoa 2019*. Wellington: Ministry for the Environment & Stats NZ. <https://environment.govt.nz/assets/Publications/Files/environment-aotearoa-2019.pdf>

<sup>35</sup>Ministry for the Environment. (2019). *Draft National Policy Statement for indigenous biodiversity*. Wellington: Ministry for the Environment. <https://environment.govt.nz/assets/Publications/Files/draft-npsib.pdf>

<sup>36</sup>Ministry for the Environment. (2020). *National climate change risk assessment for New Zealand. Arotakenga tūraru mō te huringa āhuarangi o Āotearoa*. Wellington: Ministry for the Environment. <https://environment.govt.nz/publications/national-climate-change-risk-assessment-for-new-zealand-main-report/>

<sup>37</sup>Bush, J. & Doyon, A. (2019). Building urban resilience with nature-based solutions: How can urban planning contribute? *Cities*, 95, 102483. <https://doi.org/10.1016/j.cities.2019.102483>

## Regenerative construction

The previous six issues focus on reducing harms or risks created by existing practices, minimising the potential for adverse environmental impacts or restoring environments. This seventh cross-cutting challenge focuses on being regenerative – creating new environmental and social value so that building and construction activities help environments and communities thrive.

This is illustrated by the Living Building Challenge, which asks the question ‘What if every single act of design and construction made the world a better place?’<sup>38</sup> It seeks to create buildings that connect occupants to light, air, food, nature and community. An example is Tūhoe’s Te Kura Whare.<sup>39</sup> The rating tool Green Star<sup>40</sup> provides one means to support a focus on regenerative outcomes.

There is also increasing interest in improving urban design so that it is more resilient, enhances neighbourhood self-sustainability and biodiversity, and creates more humane and equitable cities.<sup>41</sup>

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<sup>38</sup><https://www2.living-future.org/LBC4.0>

<sup>39</sup><https://www.ngaituhoe.iwi.nz/te-kura-whare>

<sup>40</sup><https://www.nzgbc.org.nz/green-star>

<sup>41</sup>For example, see <https://www.bloomberg.com/news/articles/2020-02-18/paris-mayor-pledges-a-greener-15-minute-city>, <https://www.capita.org/foundations> and <https://www.publish.csiro.au/pc/PC18026>.





“What are the second- and third-order benefits of better-designed ways of living?”

## Opportunities

The sector isn't just facing environmental challenges – the need for change more generally has long been recognised. However, system-wide leadership to help drive and sustain change has been lacking. As a consequence, the Construction Sector Accord, a partnership between the sector and the government, was established in 2019 to help the sector address the challenges and realise the opportunities it is facing in a more coordinated and focused way.<sup>42</sup>

In early 2020, the Accord produced a Transformation Plan that is a 3-year plan of action from industry and government to lift the performance of the sector. Actions are being progressed under several workstreams including Leadership, Procurement and Risk, and Regulatory Environment, and there are strong connections between all workstreams.

Later in 2020, the Environment Workstream was added to the areas of focus of the Accord's 3-year action plan. This workstream recognises that environmental challenges and opportunities occur across the sector. While some challenges are being addressed, it is often at a project or local level, and there is a lack of coordination between projects or between different environmental issues.

The focus of the Environment Workstream is on improving environmental sustainability and supporting the construction sector to prepare for changes to the way we build in and for the future. It recognises that addressing climate and environmental impacts presents opportunities as well as challenges.

BRANZ is leading this workstream. It has extensive expertise in creating sustainable building solutions and transitioning construction

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<sup>42</sup><https://www.constructionaccord.nz>

to a zero-carbon future. It also develops guides and tools for the sector, and trials new construction technologies. BRANZ works closely and collaboratively with many organisations and actors across the construction system.

The starting point for the Environment Workstream is the development of a roadmap for how the built environment and construction sector can contribute to Aotearoa New Zealand's environmental aspirations (including climate). The roadmap will help those in the sector understand their roles and contributions and the changes that are required and help align environmental performance work already occurring across the sector. It will also identify actions the Accord will focus on over the short term.

The development of the roadmap will require a discussion across the sector about how environmental sustainability and performance can be improved.

While the challenges facing the sector are great, so too are the opportunities. The government, in part through supporting the Accord, has set a strong direction of travel, and many in the sector do not need to be persuaded that change is necessary. The framework for focus and action provided by the Accord has been lacking in the past so the support and foundations now exist to make a real difference for Aotearoa New Zealand.

The built environment covers a range of industries, and so the sector is in an excellent position to influence and lead on sustainability and wellbeing aspirations not just around construction but more broadly across Aotearoa New Zealand.

Many in the sector want to address the environmental challenges, and some already are (examples are listed in the Appendix). There is widespread recognition that change is needed – what is built and how

affects the quality of the built and natural environments and the lives of New Zealanders for decades. There is much for us to build on and scale up to create real change, both within the sector and more broadly. Great ideas, excellent research and practical tools are already available. What has been missing until now is sector-level environmental leadership that enables better coordination and collaboration to implement solutions with industry and drive change. This is necessary so that we don't just focus on projects or on one particular environmental challenge.

The roadmap will allow the Environment Workstream to identify the critical areas to focus on and actions to be taken. It will also help position and align with other work already happening both as part of the Accord and outside of it.

It is essential that the Environment Workstream does not just focus on how the sector can do less environmental harm. As highlighted earlier, it also needs to identify how it can do more environmental and social good through creating additional beneficial impacts.

This work won't be easy, but it will be critical. As the *Building for Climate Change* programme recognises, the sector has a major role in helping the country meet its climate change goals.

**“Tackling the climate change challenge will require vision, commitment and perseverance as well as significant change. It won't be done overnight and it won't be easy.”<sup>43</sup>**

The examples in the Appendix are 'bright spots' in the system, where interesting new approaches or responses are being tried. These can help stimulate further positive changes.

<sup>43</sup>Ministry of Business, Innovation and Employment. (2020). *Building for climate change: Transforming the building and construction sector to reduce emissions and improve climate resilience*. Wellington: Ministry of Business, Innovation and Employment. <https://www.mbie.govt.nz/dmsdocument/11522-building-for-climate-change>

# Transitions affecting construction

To understand how to effectively overcome the challenges and realise the opportunities it is essential to take a step back and consider broader contextual changes affecting construction. The sector, along with the rest of the economy and society, is undergoing a set of critical transitions. To identify effective responses, it's necessary to consider specific environment-related changes, challenges and opportunities in the context of these transitions. Three are discussed below.

## Transition to working within planetary boundaries

Transitions to low-carbon economies, less-polluting lifestyles and other more environmentally sustainable practices are aspects of a broader societal transition to what has historically been called a “spaceship earth economy”.<sup>44</sup> This recognises that resources have limits, pollution has consequences and ways of working and living need to change to reduce consumption and waste. We are still transitioning away from a state characterised by assumptions of limitless space and resources, unconstrained consumption and exploitative behaviours.

The spaceship earth economy has been described more recently and tangibly through the concept of “planetary boundaries”.<sup>45</sup> This explicitly attempts to define where the boundaries are and where societies sit in relation to them. While many of the nine planetary boundaries are not directly applicable to construction, the concept of exceeding important environmental boundaries is. The circular economy<sup>46</sup> philosophy is a response to the spaceship transition, where growth and development work within limits and cycles, and is directly relevant to the construction system.

Transitions towards low emissions, low waste and more energy-efficient societies focus on specifics within the planetary boundary or circular economy transition.

In the construction sector, there is still a lack of knowledge about and experience with standard practices associated with the circular economy.<sup>47</sup> Sometimes the tools, skills and technologies are already suitable to begin the transition, but developing a circular economy requires changes in many areas, such as governmental policies and financing, economics, commercial and societal expectations and behaviours. A demonstration of applying circular economy practices in the construction sector is the CIRCL pavilion in Amsterdam.<sup>48</sup>

“We don’t need to wait for new technological advances. Solutions are already here.”

<sup>44</sup>Boulding, K. E. (1966). The economics of the coming spaceship earth. In H. Jarrett (Ed.), *Environmental quality in a growing economy* (pp. 3–14). Baltimore, MD: Resources for the Future/Johns Hopkins University Press.

<sup>45</sup><https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html>

<sup>46</sup><https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail>

<sup>47</sup>Benachio, G., Freitas, M. & Tavares, S. (2020). Circular economy in the construction industry: A systematic literature review. *Journal of Cleaner Production*, 260. <https://doi.org/10.1016/j.jclepro.2020.121046>

<sup>48</sup>ABN AMRO & Circle Economy (2017). *A future-proof built environment*. <https://www.circle-economy.com/resources/a-future-proof-built-environment>

## Transition to broader cultural perspectives

As well as economic and environmental transitions, Aotearoa New Zealand is undergoing a cultural transition. This transition is to a society where there is real partnership between the Crown and Māori through the Treaty of Waitangi and authentic partnerships with Māori at regional and local levels.

Te ao Māori (Māori world views) and mātauranga Māori<sup>49</sup> (Māori knowledge) are increasingly co-existing with western systems of values and knowledge. These integrate a sense of collective responsibility to and for future generations and an interdependency with the environment. The whakatauki Ko ahau te taiao ko te taiao ko ahau represents this interdependency.

## Ko ahau te taiao ko te taiao ko ahau

I am the environment and the environment is me

Iwi/Maori are looking beyond Treaty settlements and western commercial drivers and timeframes. They are seeking to develop sustainable enterprises across a range of sectors and services. These focus not just on commercial profitability, but on sustained improvement in the wellbeing of members of their iwi and communities and the preservation or enhancement of environmental values.

In the construction context, Māori businesses, trusts and organisations already have \$3 billion invested in construction assets, \$4 billion in transport and over \$4 billion associated with forestry. In 2018, 35,100 Māori were employed in construction (about 15% of the workforce).<sup>50</sup>

Increasingly Māori values and practices are informing decision making and actions, especially in relation to environmental issues. An example is Te Mana o te Wai<sup>51</sup> and the framework it provides for councils when implementing the National Policy Statement on Freshwater Management. This involves a hierarchy of obligations, prioritising the health and wellbeing of water first.

A similar hierarchy of obligations for construction can be envisaged.

1. The health and wellbeing of the environment.
2. The health needs of people (such as safe, warm and dry dwellings).
3. The ability of people and communities to provide for their social, economic and cultural wellbeing.

Several other frameworks, such as the mauriOmeter<sup>52</sup> and the Mauri Compass<sup>53</sup>, help with cultural and environmental risk assessments and inform engagement strategies. Major roading developments, such as the Puhoi to Warkworth project, often now involve alliances of hapū who act as the project's Treaty partner rather than as stakeholders.

<sup>49</sup>Environmental Protection Authority. (2020). *Guide to the mātauranga framework*. Wellington: Environmental Protection Authority. [https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/Matauranga-Maori-Report\\_Companion-Guide.pdf](https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/Matauranga-Maori-Report_Companion-Guide.pdf)

<sup>50</sup>Nana, G. et al. (2020). *Te ohanga Māori 2018: The Māori economy 2018*. Wellington: Reserve Bank of New Zealand. <https://www.rbnz.govt.nz/research-and-publications/research-programme/te-ohanga-maori-2018>

<sup>51</sup><https://environment.govt.nz/assets/Publications/Files/essential-freshwater-te-mana-o-te-wai-factsheet.pdf>

<sup>52</sup><http://mauriometer.org/WebPage/Show/2>

<sup>53</sup><https://www.mauricompass.com>



## Transition to a systemic approach

The third transition is also one of perspective. Lack of earlier progress on addressing the environmental (and other) challenges of construction and profiting from the opportunities is, in part, due to failing to take a systemic and coordinated approach. Attention has usually been paid to events or visible problems or to issues just within a project. Without understanding and addressing the underlying causes and the connections across the construction system, real change is very limited.

**“We need to use a systems approach, not a siloed approach.”**

Systemic thinking isn't common in Aotearoa New Zealand. We usually resort to structural changes rather than considering underlying incentives, behaviours and mindsets. However, climate change, the pandemic, and social inequalities are prompting greater consideration of systemic approaches.

The Accord provides the opportunity for the sector to consider systemic issues and respond in a collaborative way.

Without a systems perspective changes at a project or local issue level may have no substantive effect and could exacerbate existing problems or create new ones.

Some practical steps can be taken to improve a systems approach in the sector. The next sections provide some frameworks on how to develop and use a systems-based view to make meaningful changes.

# Making sense of the changes and transitions

Making sense of the challenges, opportunities and transitions can be difficult, but two approaches can help identify where we can best focus our attention.

## Using the Three Horizons framework to inform decisions and actions on transitions

On paper, transitions can seem inevitable and relatively straightforward but, that is rarely the case. A constructive way to think about these changes and transitions is the Three Horizons framework.<sup>54</sup>

Typically, we focus on the events and signals that we see rather than the broader context of change. This framework helps us retain the bigger picture of direction and destination while also illustrating that the path is not necessarily simple and no one person or organisation will have the solutions.

The core concept of the Three Horizons framework is that the

current “business as usual” (Horizon 1) approach becomes less successful (its strategic fit declines) as time goes by. The framework illustrates that, as Horizon 1 declines, a new way of operating (Horizon 3) slowly, but not predictably, emerges (see Figure 4).

Significant change usually involves transitional stages where different ideas and actions are tested. The transitional stage is a period of turbulence, tension and contention. It may not be a comfortable stage, but it is necessary to challenge assumptions and mindsets. The transitional stage also helps to identify and test what ideas and actions will actually help us get to the desired destination or at least moving in the right direction.

Horizon 2 is this entrepreneurial state, where there can be greater

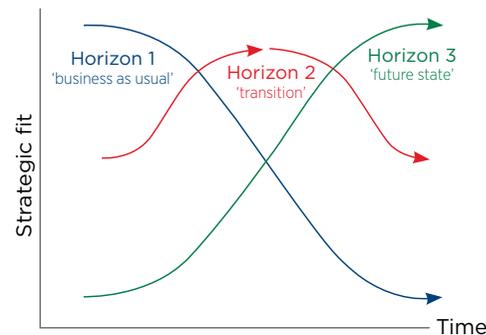


Figure 4. An outline of the Three Horizons framework.

innovation and testing and the creation of new opportunities, contradictions and risks. Only some of the ideas and approaches may shape a particular future. Transitions require shifts in assumptions, structures and practices, and the Three Horizons framework helps identify these.

We can usually identify elements of Horizon 3 in the present – weak signals and signs of change. Whether these persist

and how they develop depend on interactions with Horizons 2 and 3. Some elements of the current state usually remain in the future, and this framework helps identify what some of those should or may be.

The framework is used to generate discussions about the nature of changes as a prelude to informing actions. This method is often effective because it seeks to capture three different perspectives on the future – those involved in managing the here and now, those with different visions of the future and those interested in trying new things.

The sector can influence some of the transitions (such as low-carbon economies and low waste) but can only anticipate or react to others (such as a disrupted climate and changing societal values).

<sup>54</sup>Sharpe, B., Hodgson, A., Leicester, G., Lyon, A. & Fazey, I. (2016). Three horizons: A pathways practice for transformation. *Ecology and Society*, 21(2), 47. <http://www.ecologyandsociety.org/vol21/iss2/art47/>. The method is distinct from McKinsey's three horizons model of innovation.

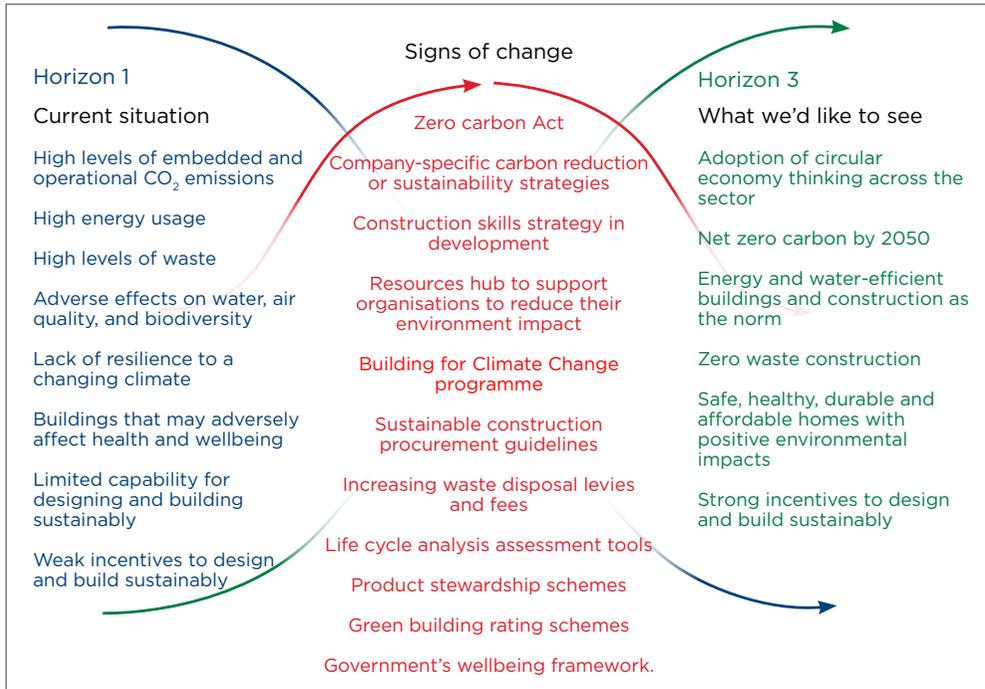


Figure 5. Three Horizons framework illustrating current and future environmental conditions, and some of the signs of change.

Figure 5 illustrates how the Three Horizons framework could be used by the construction sector and draws on insights gathered from the research and interviews undertaken for this paper. It shows some of the environmentally related issues that the sector is already seeing, what it might like to see in the future state and some already observable signs of change.

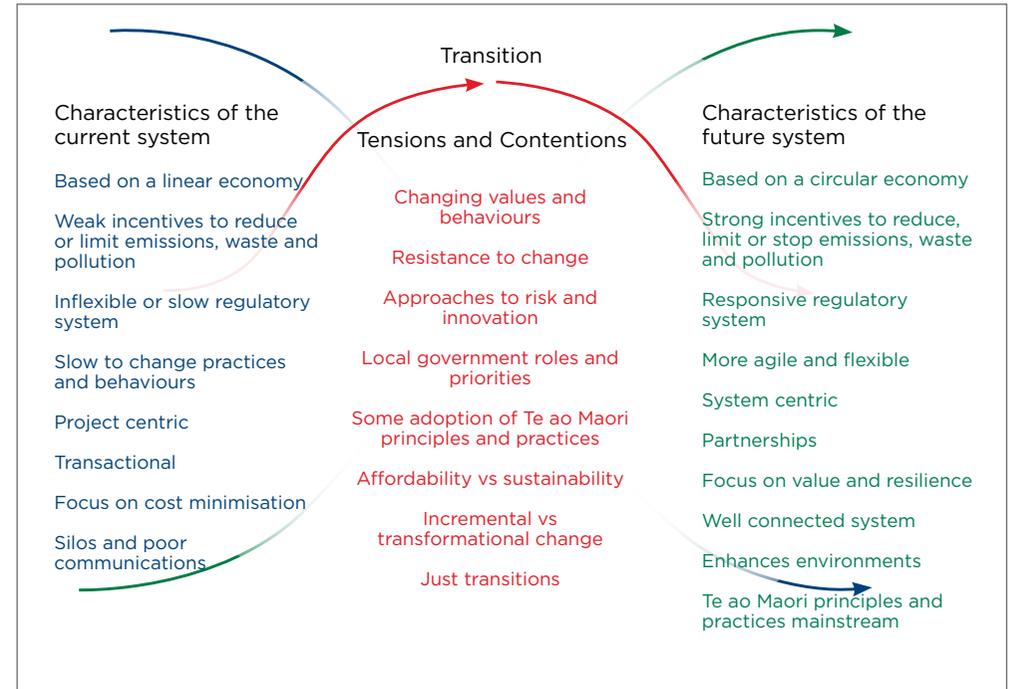


Figure 6. Changing to a more sustainable construction system requires navigating tensions and contentions.

Figure 6 illustrates some characteristics of the current and desired future construction states in relation to environmental issues. It also shows some examples of potential contentions that may need to be debated and resolved to achieve the desired future.

## A systems perspective for construction

The Three Horizon's framework helps focus on the big picture of destination and direction. It helps identify what needs to change (or stay the same), as well as what critical contentions need to be addressed. But it doesn't necessarily help identify where in the system actions are best targeted. A systems perspective helps us identify where we are focusing too much or too little attention.

It also shifts attention and actions away from the symptoms of a problem (or opportunity) and towards the underlying causes and enablers. It also highlights how other activities can influence a particular activity during and after construction. The importance that relationships, power dynamics, information flows, and underlying mental models play in influencing a construction project are also evident when adopting a systems view.

A simple system model of building and construction breaks down project activities into different stages or phases, as illustrated in Figure 7. The building and construction cycle includes design, manufacturing and procurement, construction, use and renovation or repurposing of the structure and end-of-life deconstruction (where materials may be reused, recycled or disposed of). The enabling factors associated with construction (natural environment, finance, etc.) and their general roles are also indicated. A more detailed system map of construction was recently developed by the UN, Laudes Foundation and Nexial and provides a useful perspective on flows and interactions within the system.<sup>55</sup>

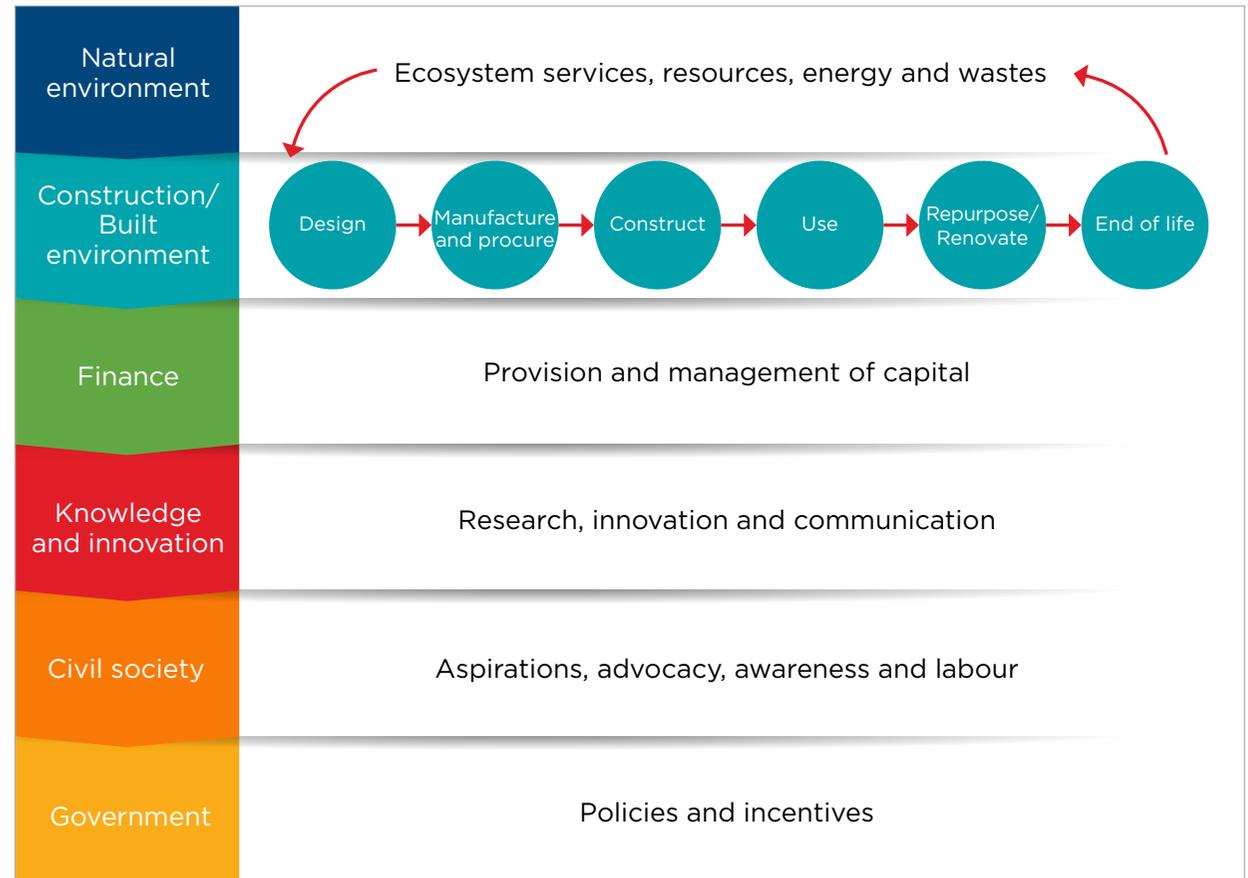


Figure 7. A simple system model for the building and construction system, illustrating the life cycle steps for a building, and factors that influence a project. Flows from and to the environment by construction are indicated.

<sup>55</sup><https://racetozero.unfccc.int/race-to-zero-built-environment-system-map-launches/>

## Interactions and relationships

A systems perspective helps identify the interactions between structures, institutions and actors involved in different parts of the construction cycle. It helps identify the different motivations and goals that these actors may have that influence their behaviours.

The system has a variety of different participants or actors (Figure 8). They will often have different motivations and goals, such as profitability, cost minimisation, risk avoidance, recognition, power, social or environmental benefits. As noted earlier, different values, experiences and world views will influence how they behave in the system.

The actors are involved to varying degrees across a construction project (Table 1). Understanding their motivations and influences is an essential step towards making real change.

Table 1. Where different actors may be more involved during and after a construction project.

	Design	Procure and manufacture	Construct	Use	Repurpose	End of life
Client and developers	✓		✓	✓	✓	✓
Construction companies	✓	✓	✓	✓	✓	✓
Industry collective	✓	✓	✓		✓	✓
Resources and logistics		✓	✓		✓	✓
Government (central and local)	✓		✓		✓	✓
Occupants and users				✓	✓	
Communities	✓				✓	✓
Financial, legal and insurance	✓		✓		✓	✓
Education and training	✓	✓	✓	✓	✓	✓

## Actors in the building and construction system



Figure 8. Some of the actors involved in building and construction.

## Trade-offs and unanticipated consequences

Thinking in terms of systems enables a better understanding of trade-offs and their consequences and the identification of potential unanticipated consequences of decisions or changes.

Examples of trade-offs in building and construction include prioritising lower costs at the expense of life-time maintenance costs and greater environmental impacts. There are also spatial trade-offs in terms of how individual project decisions impact national environmental aspirations and commitments.

For example, if recycled material for a project can't be locally sourced, then similar but not recycled products (such as steel) may be exported. As a consequence, while the project may have a lower environmental footprint, global impacts may be higher due to the additional transportation involved.

Similar potential trade-offs can occur between impacts of decisions on the present and in the future. Examples include favouring construction efficiency over longer-term resilience and considering reducing one environmental harm (such as greenhouse gas emissions) which increases another (such as more pollution or habitat disturbance).

“How do we address the low-carbon challenge at both the macro and the building level?”

Construction is typically project-focused, but environmental challenges and opportunities require the challenges or consequences of project decisions to be considered both in terms of scale and time. How do decisions or challenges on one project affect other projects and the overall environmental performance of the sector, and how do we determine this?

A systems perspective also helps identify what we might imagine is a trade-off may not be one. For example, it is often assumed that increased sustainability results in higher costs. But is that inevitable? What is generating the costs in the construction system and how could they be reduced to stimulate more sustainable practices? Similarly, a transition to a low-carbon sustainable sector doesn't necessarily need to create winners and losers in respect to jobs and incomes. How can transitions be supported to ensure there is a viable alternative future for those impacted?

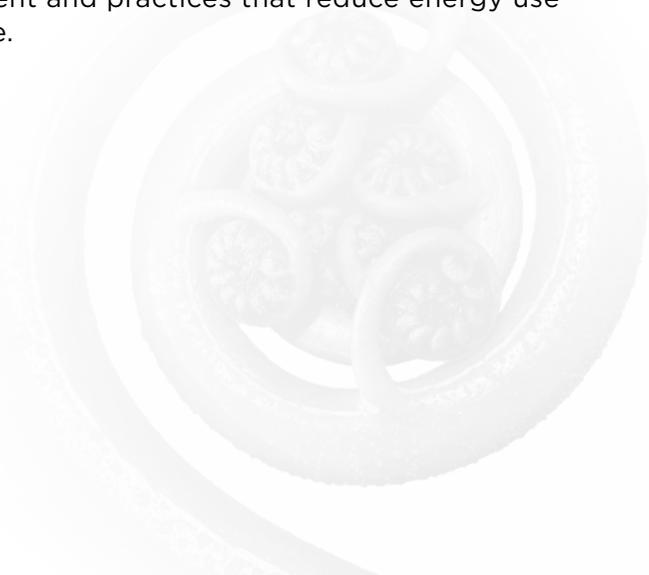
# Connecting environmental issues to the system

Table 2 illustrates that no one stage of the construction cycle has exclusive responsibility for addressing any of the environmental challenges. Some stages will have greater impact than others in different stages, but a systemic and collaborative approach will have the biggest impacts.

For example, designing for zero carbon and zero waste can have substantial impacts across the system, but further emission and waste reductions can also be achieved in other stages through additional practices and decisions. These include the use of low-emission or electric vehicles and equipment and practices that reduce energy use or waste.

Table 2. Where each stage of construction can influence the environmental challenges – two ticks indicate a relatively greater influence.

	Net zero carbon	Energy efficiency	Waste elimination	Water efficiency	Optimal land use	Climate resilience	Regenerative benefits
Design	√√	√√	√√	√√	√	√√	√√
Manufacture and procure	√√	√	√	√		√	√
Construct	√√	√	√√	√		√	√
Use	√	√√	√	√√			√√
Repurpose	√	√	√	√	√	√	√
End of life	√√	√	√	√	√		√



Examples of behaviours and practices that different actors perform and that may influence environmental sustainability and performance are shown in Table 3.

## Identifying key points of leverage

Building and construction is not a simple mechanical system but a complex adaptive system that operates under a diverse set of incentives and constraints. It is driven or influenced by different sets of actors who often have different values, goals and behaviours.

Describing the system is useful but is not an end point. Like the Three Horizons framework, it provides a basis to think more deeply and constructively about what interventions are possible or necessary.

It is easy to talk about change but harder to do it well. A BRANZ study<sup>56</sup> concluded “not only that there are few incentives to change, but there are significant and important barriers in place that disincentivise adoption of new ways”. Resistance to change, the costs, lack of skills, regulations and the pace of developments can all make change difficult.

**“Construction teams that are well-connected to their suppliers often don’t ask for what’s new. They will stick with what’s tried and tested.”**

Table 3. Roles for construction system actors in addressing environmental challenges.

	Net zero carbon	Energy efficiency	Waste elimination	Water efficiency	Optimal land use	Climate resilience	Regenerative benefits
Clients and developers	Project specifications				Site selection	Project specifications and site selection	
Construction companies	Design and materials, practices and information sharing				Design	Design and materials	
Industry collective	Vision, collective commitment and collaboration						
Resources and logistics	Transport options	Factory operations					
Government (central and local)	Policies, regulations, targets, incentives, guidance, consenting and planning				Zoning and consenting	Planning and consenting, policies and incentives	
Occupants and users	Behaviours and purchases						
Communities	Engagement with developers, occupants and policy and regulatory processes						
Financial, legal and Insurance	Negotiating conditions and requirements						
Education and training	Education, training, research and development of new practices, materials and technologies						

<sup>56</sup>Duncan, A., Kingi, V. & Brunson, N. (2018). *Adopting new ways in the building and construction industry*. BRANZ Study Report SR406. Judgeford: BRANZ Ltd. [https://d39d3mj7qio96p.cloudfront.net/media/documents/SR406\\_Adopting\\_new\\_ways.pdf](https://d39d3mj7qio96p.cloudfront.net/media/documents/SR406_Adopting_new_ways.pdf)



More-recent interviews with sector leaders identified lack of leadership skills and insufficient connection and collaboration within the sector as significant barriers to change.

Often, attempts to change a system focus on the things that are easiest to change, such as standards, levies, supplies of materials (such as wood) or land. However, these rarely have much impact on deeper systemic problems.<sup>57</sup>

### **Changing the incentives and improving information flows**

More-effective points to change a system are associated with changing the rules (such as incentives and constraints) and improving information flows. Some rules have started to change (such as waste levies and emission targets) but in piecemeal fashion.

Poor communication, sharing and collaboration are known to be factors hindering improving performance in the sector. Up-to-date data and other information about environmental impacts is often lacking or is not widely shared or accessible across the system.

Information about new materials and practices that contribute to better environmental performance and outcomes need to be more accessible across the sector. Enhancing information flows also involves generating data about the impacts and outcomes, and having feedback loops that utilise this information.

Leadership and skills need to be improved across the sector for new practices and behaviours to develop and spread. Better system-wide connections and collaboration will also be necessary to support this.

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<sup>57</sup>Meadows, D. (1999). *Leverage points: Places to intervene in a system*. Hartland, VT: The Sustainability Institute. <http://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>

## Stronger partnerships and collective action

Changing the goals and paradigms of the system, including mindsets, is the most effective and enduring strategy to ensure change and this involves a collective approach. Developing a common vision with respect to the environmental performance of the sector is critical to enable the system goals to change.

The Three Horizons framework indicates that a range of contentious issues need to be navigated. These will require trust and constructive debates to resolve them. Leadership and power structures also need to be reimagined. System leadership is not about command and control – it involves enabling others to make the changes. Power imbalances are common in construction, and there can be considerable scepticism about consultative processes and lack of trust.

Policies and practices are usually the focus of change, but to transform a system requires changing the relationships between people, and their mindset, within the system.<sup>58</sup>

More authentic partnerships are necessary to help achieve the sector's environmental aspirations. Some of the partnerships and approaches that Māori-led organisations are establishing in a variety of sectors are good models for the construction sector to consider. For example, Whenua Ora Tangata Ora is a joint partnership between FOMA Innovation, the science and technology arm of the Federation of Māori Authorities, biological farming and soil health experts Soil Connection and Toha, an environmental impact platform that recently launched Calm The Farm<sup>59</sup> to support farmers to reduce their environmental and climate impacts while improving financial resilience.

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<sup>58</sup>Kania, J., Kramer, M. & Senge, P. (2018). *The water of systems change*. Boston, MA: FSG. [https://www.fsg.org/publications/water\\_of\\_systems\\_change](https://www.fsg.org/publications/water_of_systems_change)

<sup>59</sup><https://www.calmthefarm.nz/>



# The leadership challenge

The environmental challenges, opportunities and transitions identified in this paper foreshadow the need for a new approach to leadership in the building and construction sector.

Increasingly, New Zealanders are recognising the implications and impacts of climate change and other environmental issues. The economic and social costs of extreme weather events, polluted waterways, poor air quality and plastic waste, to name a few, are stimulating public and business actions. Organisations are realising that they risk losing customers, employees and stakeholders if they aren't seen to be taking meaningful actions that reduce these negative environmental impacts.

The leadership challenge is to establish what is required to enable real change. Organisations need to first identify how they may contribute to or be impacted by climate change and poor environmental sustainability. Then they need to explore what effective and meaningful responses they could take. Reducing the negative environmental impacts of construction will require more than just adopting new technologies and practices.

Particularly for issues such as climate change, changes require actions to be embedded in everything – from strategy, through supply chain and financial incentives to organisational culture. Adopting meaningful targets and key performance indicators to meet or exceed environmental performance expectations is expected to become the norm. Introducing token actions will be quickly perceived and condemned.

Leadership in the sector needs to be less about driving change and more about enabling it. Boards will need to evolve their attitudes, skills and composition in order to better identify and support their organisation's leadership teams to enable systemic change and innovation.

This is already a complex system where no one leader or leadership position can drive change across the sector. Collective and collaborative efforts are required. Instead of a 'command and control' mindset, there is need for a leadership style that is collaborative, adaptive and open to new ideas. Leaders must also be comfortable dealing both with short-term simpler issues and longer-term complex problems. Knowledge from working on these problems will need to be shared across the broader system. Organisations will need to work with existing partners and develop new partnerships to find effective and acceptable ways to address the climate emergency, waste, pollution and broader challenges. New relationships will need to be forged with those who are most likely to be affected by the changes and transitions.

Customers and clients will be an important influence on changing the environmental performance of construction. In some cases, their needs will be powerful drivers of change. In other cases, their key motivations may be short-term and medium-term economic, functional or aesthetic considerations, or they may have a focus on only one aspect of environmental sustainability. In these situations, leaders in the sector will need to act as advocates, influencing clients' views on the benefits of more sustainable construction. To do this, leaders will need to have a systems perspective, be able to articulate the broader value proposition and have the support of others, including boards and industry bodies.

Trade-offs will be inevitable in the shift towards greater sustainability. As we are already seeing in transport decisions, some will involve shorter-term economic costs but lead to longer-term socio-economic, wellbeing and environmental benefits and value. Being explicit about such trade-offs and thinking about how they can be communicated and mitigated will be an increasingly important aspect of leadership across the sector.

Such leadership will need to balance what has been called the 'head, hands and heart' elements of leadership.

The head element of leadership is about the broader reasoning for change – the bigger picture, vision and organisational goals. It is also about recognising the role a particular organisation plays in the sector and broader social aspirations.

Hands leadership is focused on ensuring that the tools, skills, training and resources necessary for any task are available. It will also mean more than just meeting minimum sustainability regulations. Rather, it may require delivering benefits that are felt beyond the organisation.

The heart aspect of leadership is ensuring that everyone in the organisation and across the sector understands and accepts the reasons for change and why it's essential. Long-term sustainability solutions require a commitment from everyone involved, so acting and communicating clearly and consistently about the rationale for change and what's required is crucial. No one will have all the answers – others must have opportunities to contribute so that a common and sustained commitment to change is created.

The changes necessary in the sector are large and will take time. Sector leadership must anticipate resistance – from themselves and others – and work to model and encourage behaviours and attitudes that will enable the changes.

Head, hands and heart leadership for sustainability also recognises the need to challenge oneself and others about ways and means. If actions and goals are not sufficient to address the targets or aspirations of the sector and society, critiques need to be welcomed and addressed.

To succeed in improving environmental performance, leaders in Aotearoa New Zealand's building and construction sector must be prepared to change both how they perceive the challenges and opportunities and how they address them. This may require shifts in values, changes in relationships across the sector and developing new ways to inspire and enable others inside and outside the organisation.



# Broader connections

While this paper has focused on environmental aspects associated with building and construction, it is important to note there are connections to other aspects of the system.

While taking a systemic approach to environmental opportunities and challenges in construction will help enhance the sustainability and performance of the sector, there are also connections the workstream can make to broader societal aspirations.

Construction is a critical connection influence point that supports how well communities and environments are able to thrive. It is closely associated with social equity and justice through housing affordability and accessibility. Buildings play important roles in improving health and wellbeing for all. They help both personal development (through providing education, recreation and work facilities and opportunities) and economic development. Good construction improves community and economic resilience. It can also help protect biodiversity and important landscapes and improve air and water quality.

The construction sector, along with the rest of the economy and society, is in a time of significant transition. It needs to address old as well as new challenges and realise the potential of emerging opportunities. These will require collective actions and systemic changes. However, successfully navigating the transition will result not only in improved sector productivity and profitability but will make substantive contributions to Aotearoa New Zealand's broader social, environmental and climate change aspirations.





# Appendix: Some environmental initiatives in Aotearoa New Zealand construction

The table provides a collation of some initiatives and developments that show potential for delivering system-wide environmental outcomes. These are linked to the relevant environmental challenges they are seeking to address. The initiatives and developments vary in size, scale and focus, and no analysis of the value and contribution individually or collectively has been done.

Challenge	Tools, programmes, policies and strategies	Networks or alliances	Practices or products
Greenhouse gas emissions	<ul style="list-style-type: none"> <li>• Sustainable steel certification programme (Sustainable Steel Council)</li> <li>• Toitū Envirocare certification programmes, including carbon zero operational buildings rating tool (Toitū/NZGBC)</li> <li>• CO<sub>2</sub>NSTRUCT embodied greenhouse gas and energy values (BRANZ)</li> <li>• LCAQuick tool for environmental impacts (BRANZ)</li> <li>• Building for Climate Change programme (MBIE)</li> <li>• Net Zero Carbon Roadmap (NZGBC)</li> <li>• Transition to a zero carbon built environment (BRANZ)</li> </ul>	Climate and biodiversity emergency open letter (Aotearoa New Zealand Architects Declare)	40/20/20 vision for low carbon infrastructure (Watercare)
Energy efficiency	<ul style="list-style-type: none"> <li>• Office building energy efficiency rating tool (NABERSNZ)</li> <li>• Business Energy Programme (EECA)</li> </ul>	Energy Step Code Aotearoa with Primary Energy (ESCAPE) Passive House Institute of New Zealand	

Challenge	Tools, programmes, policies and strategies	Networks or alliances	Practices or products
Waste elimination	Ōhanga āmiomio – Government's work programme for waste (MfE)		<ul style="list-style-type: none"> <li>Concrete recycling scheme (Envirocon)</li> <li>PaintWise recycling scheme (Resene)</li> <li>Reusable construction frames (X-Frame)</li> <li>Recycled construction panels (saveBOARD)</li> <li>Circular Economy Model Office (Sustainable Business Network)</li> <li>Product stewardship directory (Sustainable Business Network)</li> <li>Reducing waste through deconstruction project (Kāinga Ora)</li> <li>Environmentally responsible house removal programme (Piritahi alliance)</li> </ul>
Land use	National Policy Statement on Urban Development (MfE)		
Water efficiency and pollution	<ul style="list-style-type: none"> <li>Building for Climate Change Operational Carbon Framework objective to reduce water use (MBIE)</li> <li>National Environmental Standards for Freshwater (MfE)</li> </ul>		
Climate adaptation	National Climate Change Risk Assessment for New Zealand (MfE)		Climate Safe House Project (Blueskin Resilient Communities Trust)
Generative benefits	Living Building Challenge		<ul style="list-style-type: none"> <li>Te Kura Whare living building (Ngai Tūhoe)</li> <li>Living Pā (Victoria University of Wellington)</li> </ul>
Other (multiple challenges) and sustainability	<ul style="list-style-type: none"> <li>Living Standards Framework (The Treasury)</li> <li>Building System Regulatory Strategy Building for the Future (MBIE)</li> <li>Circular Economy Accelerator (Sustainable Business Network)</li> <li>Economic plan for a productive, sustainable and inclusive economy (MBIE)</li> <li>Kāinga Ora public housing and sustainable investment framework</li> <li>Level website on sustainable building (BRANZ)</li> <li>Up-Spec data to improve performance of homes (BRANZ)</li> <li>Green Star</li> <li>Homestar</li> <li>Āmiomio Aotearoa research programme funded by MBIE aiming in part to look at circularity economy in the building and construction sector (Waikato University)</li> </ul>	Superhome Movement	