Concrete New Zealand Incorporated

Submission to

NZ PRODUCTIVITY COMMISSION

on

Low Emissions Economy Draft Report

08 June 2018

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Dear Sir / Madam

LOW EMISSIONS ECONOMY: DRAFT REPORT

Concrete New Zealand (NZ) represents a membership in excess of 700 corporates and individuals who collectively account for a significant proportion of the building and construction sector in New Zealand.

Concrete NZ replaces the Cement and Concrete Association of New Zealand (CCANZ) and speaks with a unified voice on behalf of the cement and concrete industry.

The cement and concrete industry annually supplies and uses about one and a half million tonnes of cement in New Zealand, which equates to around 4 million cubic metres of concrete for new residential, commercial and infrastructure construction.

In total, the direct, indirect and induced economic impact of the cement and concrete industry contributes approximately $7.5 billion of output across the economy. This activity supports more than 24,000 jobs and creates a value add of about $2.8 billion.

Concrete NZ welcomes the opportunity to provide feedback on the New Zealand Productivity Commission's *Low Emissions Economy: Draft Report*.

General Comments

Concrete NZ acknowledges the Commission's work with respect to the following:

- The importance of a stable and credible climate policy for New Zealand.
- The focus of the draft report on reducing emissions from all New Zealand's major sources of emissions such as agriculture and transport and the critical importance of new forestry plantings.
- That all sectors have an important role to play in the transition to a low emission economy.

Concrete NZ has limited its comments to *Section 13.6 Industrial Processes* and *Section 15 The Built Environment* and will leave it to others, such as the Engineering Leadership Forum (ELF), to comment further.

We would welcome the opportunity to meet the Commission to discuss our comments.

Section 13.6 Industrial Processes

This Section sets out a pathway using five strategies – the first three can be achieved in 10 years by changing the method of "cement" manufacture. The last two strategies would transition the construction industry to a position where the built environment is a carbon sink. The strategies are titled:

- Strategy 1 – Supplying 50% of cement demand with geopolymer cement
- Strategy 2 – Supplying 50% of cement demand with high-blend cement
- Strategy 3 – Mineral carbonation
- Strategy 4 – Using less cement
- Strategy 5 – Carbon negative cements

Concrete NZ has several serious misgivings around the five proposed strategies for cement and concrete. The strategies are taken from Australia's Beyond Zero Emissions 2017 report Z*ero carbon industry plan: Rethinking cement*[1]. They have been cut and pasted with scant consideration of its applicability in a New Zealand context. Concrete NZ comments specifically on the five proposed strategies below:

Strategy 1 – Supplying 50% of cement demand with geopolymer cement

It is claimed that "the reactions involved in making geopolymer cement do not generate GHG's". However, this does not consider activator solutions such as hydroxides and silicates that are critical for producing geopolymer concrete. Further emissions are

[1] Beyond Zero Emissions Inc. (2017). *Zero carbon industry plan: Rethinking cement*. Retrieved from http://media.bze.org.au/ZCIndustry/bze-report-rethinking-cement-web.pdf

generated as some geopolymer concretes need to be thermally activated since fly ash and slag used to replace Portland cement have low reactivity. Reported emissions for geopolymer concrete are between 48% and 90% of similar concrete made with Portland cement depending on how widely emissions were calculated.

Furthermore, there are other issues with Strategy 1:

- Availability of fly ash
- Durability performance not demonstrated
- Protection of reinforcing steel
- Setting time and strength gain
- The need for further research – especially in mix ingredients and design
- Codifying geopolymers in Standards

Strategy 2 – Supplying 50% of cement demand with high blend cement

This strategy seeks to reduce Portland cement supply by using higher levels of replacement materials such as fly ash, slag, calcined clay and limestone powder. High replacement levels are only possible when using high quality Supplementary Cementitious Materials (SCMs) such as fly ash and slag. Only a limited amount of fly ash is available from Huntly power station, which is already being used to replace cement. Access to other sources would involve importation from Asia. This technology is the easiest to adopt in New Zealand, but logistically it is limited by a lack of local resources apart from Huntly fly ash and pumicite being trialled by some cement suppliers. Furthermore, the global demand for fly ash is significant, and it is unlikely therefore to provide a long-term solution in a New Zealand context.

Please also note that high replacement levels lead to slower setting times and strength gain as cement hydration is an exothermic process. Even if available, high blend cements would not be suitable in some construction contexts.

Strategy 3 – Mineral carbonation

This strategy targets the emission of carbon dioxide from cement production, which only occurs locally at the Golden Bay Cement factory near Whangarei in New Zealand. Carbon capture relies on grinding magnesium silicate rock and converting this to magnesium carbonate and silica. Adopting this technology requires a ready source of magnesium silicate, which is not always available locally. This process can also only be applied to locally manufactured Portland cement so presumably some thought has to be given to how imported cements would be treated.

Strategy 4 – Using less cement in construction

This strategy assumes concrete structures can be designed more efficiently using higher strength material or that structures can be constructed from timber. The report states that concrete structures are "over-designed", but this ignores issue of safety and robustness required in construction in a seismically active country such as New Zealand. Using higher strength concrete may reduce the volume of concrete supplied but is unlikely to have much impact on cement volumes since higher strength will require more cement.

Timber structures are also not a simple solution since these cannot replace much of the concrete currently supplied without significant cost implications or compromising serviceability in terms of durability, fire resistance, acoustics, etc. Furthermore, New Zealand is still reeling from the leaky homes crisis which largely affected timber dwellings at an approximate cost of $23 billion.

Concrete NZ believes a more realistic way of reducing cement in construction would be to use more efficient specifications.

Strategy 5 – Carbon negative cements

This strategy believes that the development of new magnesium cement may be carbon negative when the entire life-cycle is analysed. Some research has suggested that these cements can be produced without emitting carbon dioxide and are able to absorb carbon dioxide over time by a process of carbonation. While a few start-up companies have been launched overseas the technology is far from been commercialised. Furthermore, this process requires access to magnesium such as high-quality dolomite that is not commonly found in New Zealand.

Question 1
Does NZ need to change the cement standard to allow options such as geopolymers?

Cement standards must be inherently conservative, and changes can only be based on research and sound experience. Considerable research into the availability and performance of geopolymers has to be undertaken before they could be codified. This process is likely to take more than ten years even if geopolymers were economically available.

Question 2
Do any NZ specific factors existing that would limit uptake

New Zealand has several logistical issues that would limit uptake of the strategies listed above:

- Relatively low industrial base that produces a limited amount of cement replacement materials such as fly ash and slag.
- Relatively small concrete construction market with small amount of research and development into cementitious materials with most technological change coming from overseas.
- High seismicity in most parts of the country with resultantly high structural demand on reinforced concrete structures.

Question 3
Would a higher emission price be sufficient to encourage usage of alternatives?

This would be difficult to apply to cement supply in New Zealand unless there was a mechanism to account for both locally produced and imported cement.

The strategies listed in the report are not new and have been previously considered. In some cases, research and development is still underway on achieving some of these objectives. Rapid step changes are extremely difficult to make however since a degree of conservatism is required when safety is concerned. Incremental change has proven a more successful strategy in the construction market and several initiatives are underway that will lower emissions from concrete construction in New Zealand.

A 2009 publication by the World Business Council's Cement Sustainability Initiative[2] describes scenarios reducing cement-related emissions on an international basis. This was recently revised and updated as the International Energy Agency (IEA) / Cement Sustainability Initiative (CSI) 2018 publication *Technology Roadmap: Low-Carbon Transition in the Cement Industry*[3]. This new report reflects strategies that align with the scenario of limiting a global temperature increase due to carbon emissions to 2°C. It also describes how the cement industry could go further in this ambition.

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[2] World Business Council for Sustainable Development. (2009). *Cement technology roadmap: Carbon emissions reductions up to 2050*. Geneva, Switzerland; IEA/WBCSD-CSI.
[3] International Energy Agency. (2018). *Technology roadmap: Low-carbon transition in the cement industry*. Retrieved from http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapLowCarbonTransitionintheCementIndustry.pdf

Concrete NZ therefore respectfully refers the Commission to this report, which shows that the primary emissions mitigation levers remain:

- Improving energy efficiency
- Fuel switching
- Reducing clinker content
- Keeping abreast of emerging and innovative technologies [to suit the New Zealand situation]

Section 15 The Built Environment

This Section is extremely biased towards timber construction and in some cases simply incorrect.

Concrete NZ agrees with the following bullet point on page 384:

- Emissions are generated throughout the life-cycle of buildings and infrastructure. This includes emissions embodied in the production of building materials and building processes; and emissions generated through the operation, maintenance and disposal of buildings and infrastructure.

Treated timber in construction is extremely poor in this regard, as (unlike concrete) timber must be maintained through the application of surface treatments and cannot be recycled. Indeed, treated timber in landfills decomposes to methane; an extremely potent greenhouse gas.

Whilst the report quotes a UK study by Monahan and Powell[4] which purports that timber framing and cladding has lower embodied energy, other reports counter this[5].

The embodied CO_2e values for construction materials should be used to compare construction projects over their entire life-cycle using principles such as those set out in *BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method*[6]. In the UK, the average embodied CO_2e

[4] Monahan, J., & Powell, J. C. (2011). *An embodied carbon and energy analysis of modern methods of construction in housing: A case study using a lifecycle assessment framework*. Energy and Buildings, 43(1), 179-188.
[5] Mineral Products Association. (2016). *Homepage*. Retrieved from http://www.mineralproducts.org/sustainability/index.html
[6] British Standards Institute. (2011). *BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method*. London, UK: BSI.

impact of concrete is around 100kg CO_2e per tonne[7]. The embodied CO_2e of concrete compares favourably with both steel and timber when compared at the building level.

Over the entire life-cycle of a home, the operational CO_2 emissions of a house have far more environmental impact than the embodied CO_2 of the materials used to build it. Some 50% of the carbon emissions are due to the energy used to heat, cool and light buildings. It is essential, therefore, that energy consumption during a building's life-cycle is considered when evaluating construction materials. A building's environmental impact does not stop once it has been built.

Independent research carried out by Arup Research & Development[8], takes account of experts' predictions for climate change and demonstrates that the thermal mass in masonry homes reduces the need for air conditioning.

It also highlights the additional savings that can be achieved through using thermal mass to capture solar gains, thereby reducing the consumption of winter heating fuel. These savings can offset the slightly higher level of embodied CO_2 in a masonry house in as little as 11 years and ultimately lead to the lowest whole life CO_2 emissions[9].

About Concrete

Concrete and cement manufactures are united in their efforts to reduce the industry's environmental impact. The industry continues to invest in modern technology and practices that minimise emissions and energy consumption. It is interesting to consider that:

- Waste materials is used as fuel in cement kilns including old tyres, wood waste, used oil and other unwanted matter that might otherwise end up in landfill.
- Improvements in kiln technology have improved the energy efficiency of cement manufacture.
- Recycled coarse and fine aggregate can substitute the use of some virgin aggregates.

[7] MPA The Concrete Centre. (2016). *Carbon management*. Retrieved from http://www.mineralproducts.org/sustainability/data.html#carbon
[8] MPA The Concrete Centre. (2016). *Whole-life carbon and buildings*. London, United Kingdom: The Concrete Centre.
[9] Ibid.

Summary

In summation, Concrete NZ considers the New Zealand Productivity Commission's *Low Emissions Economy: Draft Report* to be a vital and positive document that will encourage pan-industry discussion, which is necessary to bring about any telling emissions reduction in the future.

Concrete NZ appreciates the opportunity to provide feedback on the Draft Report.

Yours faithfully

Rob Gaimster
CHIEF EXECUTIVE OFFICER

References

1. Beyond Zero Emissions Inc. (2017). *Zero carbon industry plan: Rethinking cement*. Retrieved from http://media.bze.org.au/ZCIndustry/bze-report-rethinking-cement-web.pdf
2. World Business Council for Sustainable Development. (2009). *Cement technology roadmap: Carbon emissions reductions up to 2050*. Geneva, Switzerland; IEA/WBCSD-CSI.
3. International Energy Agency. (2018). *Technology roadmap: Low-carbon transition in the cement industry*. Retrieved from http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapLowCarbonTransitionintheCementIndustry.pdf
4. Monahan, J., & Powell, J. C. (2011). *An embodied carbon and energy analysis of modern methods of construction in housing: A case study using a lifecycle assessment framework*. Energy and Buildings, 43(1), 179-188.
5. Mineral Products Association. (2016). *Homepage*. Retrieved from http://www.mineralproducts.org/sustainability/index.html
6. British Standards Institute. (2011). *BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method*. London, UK: BSI.
7. MPA The Concrete Centre. (2016). *Carbon management*. Retrieved from http://www.example.com/thepage.htm
8. MPA The Concrete Centre. (2016). *Whole-life carbon and buildings*. London, United Kingdom: The Concrete Centre.