



A structural analysis: Designing our way into sustainability

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Abstract

With the average global temperature on the rise sustainable solutions are needed to combat climate change. The Paris Agreement was created to keep the average global temperature below a 2°C increase from pre-industrial levels. New Zealand, signatory to the Paris Agreement, has new legislation on a Zero Carbon Amendment Act to reduce all emissions to net carbon zero by 2050. 20% of all carbon emissions in New Zealand, half derived from construction and materials (embodied carbon), are from buildings.

The New Zealand Green Building Council (NZGBC) published a Zero Carbon Road Map to achieve the 2050 goal, including reducing embodied carbon 20% by 2025. Considering the structure alone, using sustainable materials can be challenging to apply to a project due to industry standards and code requirements. One method, discussed in this paper, can be implemented immediately, which is to study how different framing methods affect the amount of embodied carbon in the superstructure and substructure for a potential reduction of up to 20%.

Keywords: Structure; Embodied Carbon; Sustainable Design; Sustainable Structure; Net Carbon Zero.

1 Introduction

As the average global temperatures continue to rise the term sustainability is no longer a catch phrase to sell a product but is becoming a requirement. Knowing what the product is made of and where the materials come from has become a necessity in all industries as this knowledge can be highly important to keep the rise of global temperatures at a minimum. The 2015 Paris Agreement has 187 countries ratified to maintain a global temperature rise to less than 2°C with a strong attempt to keep the temperature rise to less than 1.5°C above pre-industrial levels [1]. Since 1990 the greenhouse gas emissions from the energy sector in New Zealand have risen 38.2%, most originating from transportation and the use of fossil fuels for manufacturing and construction [2].

On 13 November 2019, the Climate Change Response (Zero Carbon) Amendment Act received Royal Assent and became law. This act requires that the net emissions of all greenhouse gas (GHG) emissions, save biogenic methane, be reduced to zero by 2050, and will implement 5-year targets throughout this period [3]. With the built environment being a large producer of greenhouse gas (GHG) emissions, around 20% in New Zealand, it is one industry that can play a large role and is a key figure in target setting [4][5]. The New Zealand Green Building Council (NZGBC) published a Zero Carbon Road Map in response to the government's Zero Carbon Amendment Act prior to it being signed into law. This road map provides recommendations on the five-year incremental targets to achieve zero carbon emissions by 2050. The National Renewable Energy Laboratory (NREL), in the United States, defines a net-zero energy