



## Let's Get Serious With Sustainable Substation Structures

Digvijay Singh  
Ergo Consulting Ltd.

## Background



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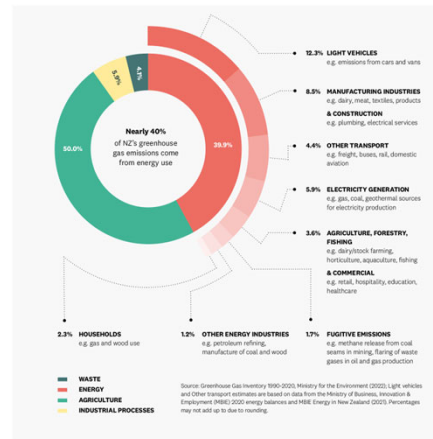
# Acknowledgements

- Stuart Dring, Senior Structural Engineer
- Ergo Consulting
- Connells Contractors
- Cassidy Construction
- Electricity Engineers' Association

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# Introduction



Graphic illustrating the breakdown of greenhouse gas emissions in New Zealand



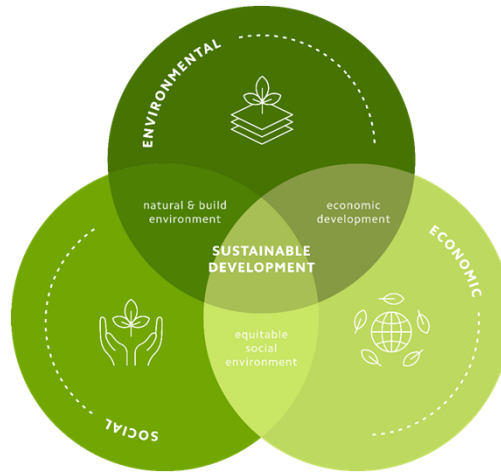
NZ Net Zero Goal for 2050. Referenced: <https://balcasenergy.com/net-zero-by-2050/>

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## Sustainability

- A growing population, further residential development and electrification leading to more substation buildings.
- How do we construct with the environment in mind?
- Are there any societal concerns we need to discuss?
- Creating infrastructure whilst keeping costs down.



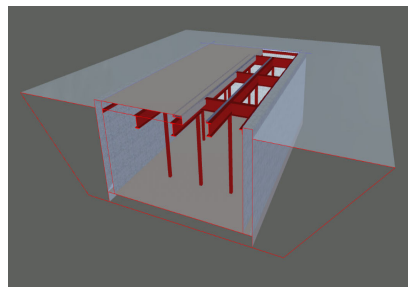
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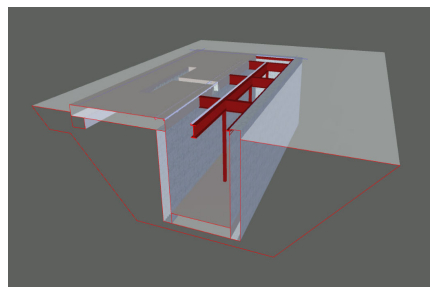
## Research Paper

Understanding the Carbon Footprint and Sustainability of Traditional Switchroom Substructure Construction

- Comparison of CO<sub>2</sub>eq emissions
- Full Cable Basement vs Part Cable Basement



3D model of the Full basement Configuration

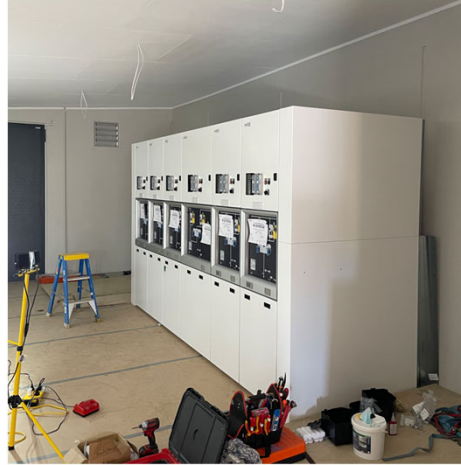


3D Model of the Partial basement Configuration

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## What does a Switchroom look like?



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## What materials are used?

- Concrete
  - Durability
  - Fire Rating
  - Waterproofing
  - Precast or in-situ
- Steel
  - Ease of Construction
  - Lightweight
  - Strength
- Masonry
  - Fire Rating
- Timber?
  - Renewable
  - Common in Residential

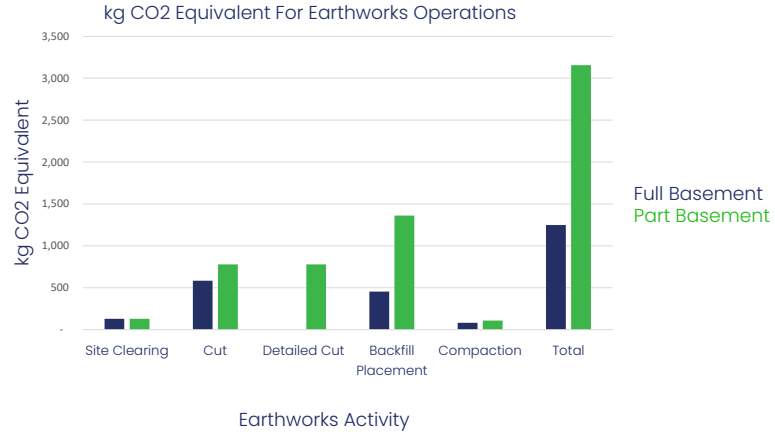


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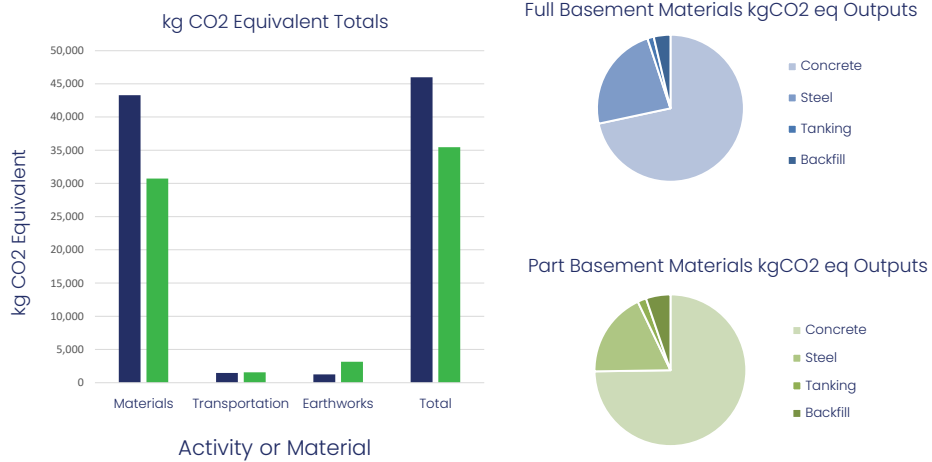
## Earthworks Emissions Results



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## Total Carbon Emission Results



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## Cost and Time Comparison



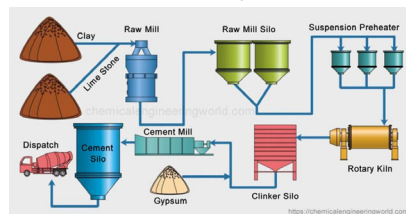
- The proposed Full Basement was quoted as only **0.1%** more than the Partial Basement. This is for the entire building, not just the basements.
- The Partial Basement was programmed to finish almost **2 months** after the Full Basement

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## Concrete- Is It A Problem?

- So what can we do about this?
  - Is it actually a problem? And what's the way forward?
- Using Low Carbon Concrete
- High use of timber in the residential sector
- Potentially using a mixture of materials above the basement
  - Further research in hybrid systems
- Emissions from high content of reinforcing steel
- Consider all three pillars of sustainability




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The complex partial basement construction resulted in larger earthworks carbon emissions.



Concrete volume has the largest significance in carbon emissions. Optimise volumes and use low carbon concrete where viable.




Transportation may be a bigger factor on rural projects where distances are larger.


**DISCUSSION AND LEARNINGS**

A simplified basement layout reduces the risk of construction errors and time to construct.

Where excavated material does not contain toxicants, spread on site.




Local contractors should be used where possible, to minimise carbon outputs and labour charges.




The cost for both configurations is quite similar as the partial basement takes longer to construct.

Explore other variations of switchroom buildings, such as an elevated building.



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## Thank you! Questions?

The graphic features the words "WHY SO SERIOUS?" in a stylized, hand-painted font. "WHY" and "SO" are in white, while "SERIOUS?" is in red. Below it, the text "...ABOUT SUSTAINABILITY" is written in a smaller, white, sans-serif font.

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Thank you! Questions?

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