**Whole-of-life Embodied Carbon Assessment Report Template**



Life Cycle Assessments (LCA)

for New Build Projects in Schools

Ministry of Education

Version 1.0 September 2022

**Table of Contents**

[1 Introduction 4](#_Toc112849279)

[1.1 User guide for this reporting template 4](#_Toc112849280)

[1.2 Summary of actions for each design stage 4](#_Toc112849281)

[2 Project Information 7](#_Toc112849282)

[2.1 Project and Building Description 7](#_Toc112849283)

[2.2 Estimated Building Construction Cost 7](#_Toc112849284)

[2.3 Building Meta-data 8](#_Toc112849285)

[2.4 Modelling Tools 9](#_Toc112849286)

[3 Modelling Assumptions 10](#_Toc112849287)

[3.1 Life Cycle Assessment Assumptions 10](#_Toc112849288)

[3.2 BRANZ reference datasets 10](#_Toc112849289)

[3.3 Embodied Carbon Assumptions 11](#_Toc112849290)

[3.4 Operational Carbon and Energy Modelling Assumptions 11](#_Toc112849291)

[3.5 Building Element Categories for LCA: 12](#_Toc112849292)

[3.6 Placeholder Values 13](#_Toc112849293)

[4 Masterplanning – 50% 14](#_Toc112849294)

[4.1 Potential Environmental Design Strategies for the Masterplan 14](#_Toc112849295)

[5 Masterplanning – 100% 15](#_Toc112849296)

[5.1 Preferred Environmental Design Strategies for the Masterplan 15](#_Toc112849297)

[6 Preliminary Design - 50% 16](#_Toc112849298)

[6.1 Summary of Key Building Elements Options Analysis 16](#_Toc112849299)

[6.2 Detailed Option Analysis for Structure and Envelope Elements 17](#_Toc112849300)

[7 Preliminary Design - 100% 22](#_Toc112849301)

[7.1 Summary of Finalised Structure and Envelope Selections 22](#_Toc112849302)

[7.2 Calculating embodied carbon for non-structural and building service elements 22](#_Toc112849303)

[7.3 Life Cycle Assessment Summary – Preliminary Embodied Carbon Results (GWP kgCO2e) 23](#_Toc112849304)

[7.4 Life Cycle Assessment: Embodied Carbon Results (Graphed) 25](#_Toc112849305)

[7.5 Summary of Potential Operational Efficiency Strategies 26](#_Toc112849306)

[8 Developed Design – 50% 27](#_Toc112849307)

[8.1 Summary of Optioneered Building Elements 27](#_Toc112849308)

[8.2 Updated Embodied Carbon Results 28](#_Toc112849309)

[8.3 Embodied Carbon Analysis Results 31](#_Toc112849310)

[9 Developed Design – 100% 34](#_Toc112849311)

[9.1 Life Cycle Assessment Summary: Finalised Building Element Selections 34](#_Toc112849312)

[9.2 Life Cycle Assessment Summary: Embodied Carbon Results (GWP kgCO2e) 35](#_Toc112849313)

[9.3 Life Cycle Assessment: Embodied Carbon Results (Graphed) 36](#_Toc112849314)

[9.4 Summary of Preferred Operational Efficiency Strategies 37](#_Toc112849315)

[9.5 Energy Modelling (Optional) 38](#_Toc112849316)

[9.6 Operational Carbon Results (Optional) 38](#_Toc112849317)

[9.7 Life Cycle Assessment – Whole-of-Life Results (Graphed) 39](#_Toc112849318)

[10 As Built 40](#_Toc112849319)

[10.1 Summary of Materials Used in Construction 40](#_Toc112849320)

[10.2 As-Built Life Cycle Assessment Update: Embodied Carbon Results (GWP kgCO2e) 42](#_Toc112849321)

[10.3 As-Built Life Cycle Assessment: Embodied Carbon Results (Graphed) 43](#_Toc112849322)

[10.4 Energy Modelling (Optional) 44](#_Toc112849323)

[10.5 Operational Carbon Results (Optional) 44](#_Toc112849324)

[10.6 Life Cycle Assessment: Whole-of-Life Results (Graphed) 45](#_Toc112849325)

[11 Appendices 46](#_Toc112849326)

[Appendix 1: Building System Elements Categorisation: Detailed list of LCA inclusions and exclusions for each category 46](#_Toc112849327)

[Appendix 2: Glossary 50](#_Toc112849328)

[Appendix 3: Masterplanning 50% - Supporting Documentation 52](#_Toc112849329)

[Appendix 4: Masterplanning 100% - Supporting Documentation 52](#_Toc112849330)

[Appendix 5: Preliminary Design 50% - Supporting Documentation 52](#_Toc112849331)

[Appendix 6: Preliminary Design 100% - Supporting Documentation 52](#_Toc112849332)

[Appendix 7: Developed Design 50% - Supporting Documentation 52](#_Toc112849333)

[Appendix 8: Developed Design 100% - Supporting Documentation 52](#_Toc112849334)

[Appendix 9: As-Built - Supporting Documentation 52](#_Toc112849335)

[Appendix 10: Carbon Reduction Strategies (MBIE) 53](#_Toc112849336)

Version Control

|  |  |  |
| --- | --- | --- |
| **Version** | **Date** | **Notes** |
| Version 1.0 | 1 September 2022 | First general release: LCA reporting on embodied carbon for new builds |

# Introduction

This report template sets out the Life Cycle Assessment (LCA) assumptions, report format, and information required when undertaking whole-of-life carbon assessments on a Ministry of Education (Ministry or MoE) new build project.

* 1. User guide for this reporting template

|  |  |
| --- | --- |
| Item | Guidance comments |
| Order of work | With a few exceptions, this document is set out to follow a sequential, chronological order. As you work through a design stage, completing each section in the order they are arranged should work best for workflow. |
| Text in blue font | *Blue font indicates areas in the template to be filled out by project teams.* |
| Supporting information | If supporting information is provided, check the yes box in the relevant section of the report, and refer to the specific attached information as needed to support any summary comments. |
| Collapsing Sections | For ease of document scrolling, we have made each header collapsible. |
| Navigation from the contents page | Each content header will hyperlink you to the section. |
| Update the content page numbers | If you feel comfortable doing so, update the content page numbers only when adding content. |

* 1. Summary of actions for each design stage

| Project Phase | Summary of actions for each design stage |
| --- | --- |
| Project start and all design stages | * Ensure [*section 2*](#_Project_Information)*, Project Information* is filled out and up-to-date * Provide supporting information in the relevant design stage appendices, as needed. |
| Masterplanning 50%  [*Section 4*](#_Masterplanning_–_50%) | * A brief written summary that:   + includes potential environmental design strategies to be considered within the project’s Masterplan   + highlights key risks and constraints for the site   + identifies opportunities for positive interventions |
| Masterplanning 100%  [*Section 5*](#_Masterplanning_–_100%) | * A brief written summary that provides a recommended environmental design strategy to:   + minimise carbon emissions,   + minimise environmental impact, and   + take advantage of positive opportunities |
| Preliminary Design 50%  [*Section 6*](#_Preliminary_Design_-) | * Identify viable options for each system listed under *substructure, superstructure* and *building envelope* in [*section 6.1*](#_Preliminary_Design_-)*.* * Summarise constraints, if any, that limit the ability to select low carbon options. * Undertake initial LCA option analysis and report the information in [*section* *6.2*](#_Preliminary_Design_-). * Select preferred *substructure, superstructure* and *building envelope* systems and provide summary comments to support these selections. |
| Preliminary Design 100%  [*Section 7*](#_Preliminary_Design_-_1) | * List the preferred *substructure, superstructure* and *building envelope* systems. * Provide an update on any constraints limiting the ability to select low carbon options. * Undertake an LCA to measure embodied carbon, bringing together:   + *Substructure* (using preferred selections)   + *Superstructure* (using preferred selections)   + *Building envelope* (using preferred selections)   + *Non-structural internal elements* using either:     - Ministry placeholder values, or     - project specific values if they are known.   + *Building services* using:     - Ministry placeholder values for *building services (HVAC and lifts)* plus values for *any other significant* services (if known). * Provide brief summaries for:   + how the project is tracking against Ministry carbon targets, and   + potential strategies to provide operational efficiencies * Complete [*section 2.2*](#section) and provide estimated costs per m2 for your preferred design options, and check whether [*section 2*](#_Project_Information) is up-to date. |
| Developed Design 50%  (if required)  [*Section 8*](#_Developed_Design_–_1) | * Confirm finalised selections for *substructure, superstructure and building envelope* elements*.* * If not done already, list viable options for *non-structural internal elements* and *building services* in [*section 8.1*](#_Developed_Design_–_1). * Summarise constraints, if any, that limit the ability to select low carbon options. * Select preferred *non-structural internal elements* and provide summary comments to support these selections. |
| Developed Design 100%  (if required)  [*Section 9*](#_Developed_Design_–) | * List the finalised *substructure, superstructure and building envelope* element selections in section 9.2 * Provide an update on any constraints limiting the ability to select low carbon options. * Update or complete a full LCA to measure embodied carbon, bringing together:   + *Substructure* (finalised selections)   + *Superstructure* (finalised selections)   + *Building envelope* (finalised selections)   + *Non-structural internal elements* (finalised selections)   + Ministry placeholder values for *building services (HVAC and lifts)* plus values for *any other significant* services (if known). * Energy modelling to measure operational carbon is encouraged if there are benefits to the project in doing so, but not mandatory. * Complete [*section 2.2*](#_Project_Information) and provide estimated costs per m2 for your preferred design options, and check whether [*section 2*](#_Project_Information) is up-to date. |
| As-Built  [*Section 10*](#_As_Built) | * Complete the summary table of building system elements that have been used on the project.   If required:   * Complete a full LCA to reflect the environmental impact of the as-built building. * If energy modelling was undertaken to measure operational carbon, we may request an updated report. * Complete [*section 2.2*](#_Project_Information) and provide estimated costs per m2 for your preferred design options, and check whether [*section 2*](#_Project_Information) is up-to date. |

# Project Information

* 1. Project and Building Description

Please provide a description of the project i.e., construction of a new classroom block consisting of 6 learning hubs etc.

<*write here>*

* 1. Estimated Building Construction Cost

Please track the building construction cost estimated at each phase in the table below. This information may be useful for supporting options at key decision making milestones if the information is available.

Building Construction Cost

|  |  |  |  |
| --- | --- | --- | --- |
| Project Phase | Building Construction Cost (Total) | Building Construction Cost  (per m2 GFA Total) | Embodied Carbon Gross  (per m2 GFA Total) |
| Preliminary Design 50% | $ | $ per m2 (GFA Total) | (Not required) |
| Preliminary Design 100% | $ | $ per m2 (GFA Total) | 000 kgCO2e/m2 |
| Developed Design 50% (Optional) | $ | $ per m2 (GFA Total) | (Not required) |
| Developed Design 100%  (Optional) | $ | $ per m2 (GFA Total) | 000 kgCO2e/m2 |
| As-Built Design  (Optional) | $ | $ per m2 (GFA Total) | 000 kgCO2e/m2 |

* 1. Building Meta-data

This information is important for the Ministry to be able to analyse the carbon impact of school buildings with differing environmental conditions and building typologies.

Reporting requirements to be aligned with [MBIE’s Whole-of-Life Embodied Carbon Assessment: Technical Methodology](https://www.building.govt.nz/assets/Uploads/getting-started/building-for-climate-change/whole-of-life-embodied-carbon-assessment-technical-methodology.pdf) (MBIE, 2022, p.8), and Ministry where available.

Please record the building’s meta-data in the table below:

Building meta-data

|  |  |
| --- | --- |
| Building Meta-data | |
| City | e.g., Auckland |
| Postcode | e.g., 1052 |
| H1 Climate Zone | e.g., Zone 1 |
| Seismic Zone | e.g., Zone 1 |
| Importance Level | e.g., IL2 |
| Building SPG NFA | 000 m2 (From SPG) |
| Building SPG GFA | 000 m2 (From SPG) |
| Building External GFA \* | 000 m2 |
| GFA Total \*\* = Building SPG GFA + Building External GFA | 000 m2 |
| Ground Floor Plate Gross Area | 000 m2 |
| Number of Storeys Above Grade | e.g. 3-storeys |
| Number of Storeys Below Grade | e.g. 1-storey |
| Structural Frame Type (pick one)  Steel  Concrete  Timber ☐ Combination | |
| Floor Structures  Concrete  Timber  Combination | |

\* External area on floors and vertical circulation above ground level used for building access or outdoor learning. This includes external stairs, decking or ramps to ground and upper floors but not paved areas to the ground floor.

\*\* This is to be used as the GFA for carbon per square metre calculations. A definition for GFA can be found in the glossary.

* 1. Modelling Tools

Please confirm below which modelling tools have been used. If the tools used vary as the project progresses, please note in the ‘Other’ tab, or below, how data was collected for each phase.

### **Life Cycle Assessment** Modelling Tool - Global Warming Potential

|  |  |  |  |
| --- | --- | --- | --- |
| BRANZ LCA Quick | eTool | One Click LCA | Other (please specify) |
| ☐ |  |  |  |

### Energy Modelling

|  |  |  |  |
| --- | --- | --- | --- |
| IES | Energy Plus | Sefaira | Other (please specify) |
|  |  |  |  |

### Materials Quantity Data Collection

|  |  |  |  |
| --- | --- | --- | --- |
| BIM (Revit / Archicad) | QS | Drawing measure | Other (please specify) |
|  |  |  |  |

# Modelling Assumptions

* 1. Life Cycle Assessment Assumptions

The life cycle Assessment assumptions that are to be used throughout this report are listed in the table below.

Life Cycle Assessment Assumptions

|  |  |
| --- | --- |
| Assumptions | |
| Building Design Life | **50-years**  (As per MBIE/ Building Act Section 113)  A 50 year design life is for consistent LCA reporting purposes only. We encourage resilient and durable designs to exceed this building design life. |
| Energy Emissions Factor  (Grid) | Use BRANZ’s Environmental Scenario Guidance to determine energy emissions factors for the New Zealand electrical grid  [New Zealand grid environmental factors (module B6)](https://www.branz.co.nz/documents/993/Module_B6_NZ_grid_electricity_factors_-_MBIE__ICCC_2019_Scenarios_v1_-_final.xlsx) |
| Material Data | Refer to BRANZ module datasets listed in Section 3.2 if project specific EPD module data is incomplete.  Section 3.3 outlines MBIE’s carbon data quality hierarchy. |
| Carbon per m2 Calculations (kgCO2e/m2) | For carbon calculations that are per square metre, use the *GFA Total* within the table in [*Section 2.3*](#_Project_Information) |

* 1. BRANZ reference datasets

The reference datasets to be used throughout this report are linked in the table below.

Weblinks to BRANZ reference datasets

|  |  |
| --- | --- |
| Module | Reference |
| A4 | [Construction transport (module A4)](https://www.branz.co.nz/documents/994/NZ_WBWLF_-_Module_A4_transport_datasheet_v1.xlsx) |
| A5 | [Construction site waste (module A5)](https://www.branz.co.nz/documents/995/Construction_site_waste_module_A5_v1.xlsx) |
| B2 | [Building materials maintenance (module B2)](https://www.branz.co.nz/documents/997/Building_materials_maintenance_module_B2_v3.xlsx) |
| B4 | [Building materials replacement (module B4)](https://www.branz.co.nz/documents/998/Building_materials_replacement_module_B4_v2_-_final.xlsx) |
| C1 | [Building end-of-life (module C1)](https://www.branz.co.nz/documents/1001/Building_end-of-life_module_C1_v1.xlsx) |
| Materials Data | BRANZ [CO₂NSTRUCT](https://branz-production.springload.nz/shop/catalogue/branz-co2nstruct_774/). |

* 1. Embodied Carbon Assumptions

MBIE’s Embodied Carbon Data Quality table below shows the preferred hierarchy for quality of embodied carbon data.

Embodied Carbon Data Quality Hierarchy (MBIE)

|  |  |  |
| --- | --- | --- |
| Level of Data Quality | Material or product specification and data quality | Material or product embodied carbon data |
| Highest  (preferred)  5 | As-built information for material/ product specifications and quantities, that include allowances for site waste | EN 15804 compliant EPD for specific product used in building |
| 4 | Detailed Schedule of Quantities, reflecting amounts and specifications of materials included in the building contract | New Zealand sector EN 15804 compliant EPD for product type |
| 3 | Quantities take-off from a BIM model used in the design process | Global EN 15804 compliant EPD for product type |
| 2 | Rough estimates of material quantities and material types at early stage/ concept design | Embodied carbon data for product type from non-EN 15804 compliant EPD, or other databases |
| 1  Lowest  (to be avoided) | Benchmarked material quantity data from similar building types | Placeholder values |

* 1. Operational Carbon and Energy Modelling Assumptions

Energy modelling to measure operational carbon is not mandatory and inclusion of this requirement will be discussed at the individual project level.

The table below provides the assumptions that are to be used.

Operational Carbon and Energy Modelling Assumptions

|  |  |
| --- | --- |
| Operational Carbon and Energy Modelling Assumptions | |
| Usage Assumptions | [DQLS Standards](https://www.education.govt.nz/school/property-and-transport/projects-and-design/design/design-standards/designing-quality-learning-spaces/) |
| Climate Scenarios | NIWA specific to climate zone |
| Inclusions | * Lifts (refer BRANZ CO2NSTRUCT) * Lighting (TBC) * Plug loads (5.4 W/sqm based on NZS 4243.1: 2007) |
| Exclusions | To be confirmed |
| Water (for future inclusion) | To be confirmed |

* 1. Building Element Categories for LCA:

We have largely adopted [*MBIE’s Embodied Carbon Technical Methodology*](https://www.building.govt.nz/assets/Uploads/getting-started/building-for-climate-change/whole-of-life-embodied-carbon-assessment-technical-methodology.pdf) for our building element items and categories to be used for LCA. The table below summarises the building element categories. [Appendix 1](#_Appendices) provides a detailed list of building elements included in each of the categories.

Building Element Categories (Adapted from MBIE)

| Building System | Elements (MBIE) | Notes |
| --- | --- | --- |
| Substructure | * Foundations/ Substructure * Earth retaining structures * Basements | Refer to Appendix 1 for Building System Element scope, categorisation, and level of detail |
| Superstructure | * Ground floor structure * Upper floor(s) structure * Load bearing systems * Roof structure * Stairs \* | Refer to Appendix 1 for Building System Element scope, categorisation, and level of detail |
| Building Envelope | * Cladding/ Façade (incl. openings) * Roof system | Refer to Appendix 1 for Building System Element scope, categorisation, and level of detail |
| Non-Structural Internal Elements | * Internal floor finishes * Internal non-loadbearing walls * Internal wall finishes * Internal doors * Ceilings \* | **122 kgCO2e/m2**  (BRANZ placeholder value that can be used for Non-structural Internal Elements in Preliminary Design 100%) |
| Building Services | * HVAC equipment * Lifts and escalators \*\* | **91 kgCO2e/m2**  (Placeholder value that can be used for *Building Services* throughout an LCA – any vertical transport, solar, water collection values must be added to the placeholder value) |
| * Other Significant | Refer to Appendix 1 for Building System Element scope, categorisation, and level of detail |

\* *The MBIE Embodied Carbon Technical Methodology states these elements are ‘voluntary’ for reporting. For Ministry LCA reports, these items are mandatory for inclusion due to their impact on overall emissions.*

*\*\* The MBIE Embodied Carbon Technical Methodology states these elements as ‘voluntary’ for reporting. For Ministry LCA reports, these items are mandatory for inclusion due to their impact on embodied and operational emissions. At the time of writing, MBIE has categorised this item as ‘Structure’, but for consistency with CBI classification it has been re-categorised as a ‘Building Services’ item for Ministry LCA reports.*

* 1. Placeholder Values

For *non-structural internal elements* and *building service* elements, we provide some placeholder values for embodied carbon to allow design teams the option of a simplified LCA at Preliminary Design if specific values aren’t known.

The placeholder values for *non-structural internal elements* and *building services* are shown in the [*section 7.3*](#_Preliminary_Design_-_1) tables (black font, top row) in per m2 quantumsums.

These values need to be multiplied by the floor area to evaluate total embodied carbon (GFA Total (m2) x placeholder values = total carbon). The project’s GFA Total value should be noted in [*section 2*](#_Project_Information)*.*

### What is included in Building Services placeholder values

Embodied carbon data for HVAC building services is not yet well understood, and some items are excluded from MBIE’s LCA methodology.

The *building services* placeholder value covers general building heating and/or HVAC, and lifts.

Our LCA methodology excludes embodied carbon for general services such as ICT, electrical, security and water in accordance with the current MBIE methodology. If you wish to include these figures in your LCA, this is okay but they must be reported separately from the LCA Report Template totals.

### What data needs to be added if you use the *Building Services* placeholder

If your project includes solar PV or heating, rainwater collection or other significant\* additions then their embodied carbon values must be added onto the *Building Services* placeholder value.

*\* See* [*appendix 1*](#_Appendices) *in the LCA Report Template for further detail on what is to be included and excluded when undertaking an LCA for us, including what is a significant addition.*

### Using Project-specific Values

Placeholder values can be overwritten where more accurate values are known to a project team.

If using project-specific values, they must be used for every LCA module, i.e. placeholder values and specific values cannot be mixed. For reader clarity, please change the colour of overwritten placeholder values to green text.

If your project is not using a full HVAC system or a lift, we recommend using project-specific data (if available) for lifts and any heating, cooling and ventilation systems.

# Masterplanning – 50%

* 1. Potential Environmental Design Strategies for the Masterplan

Provide a concise summary (not a full report) of:

* the potential site-wide environmental design strategies that could be considered for the school’s Masterplan
* strategies to minimise the whole-of-life embodied and operational carbon for any new building projects
* any limitations due to site or project constraints (e.g., site conditions)
* any viable innovative solutions that could be considered.

See [Appendix 10](#_Appendices) for a summary of MBIE’s carbon reduction strategies. The table below summarises factors that [DSNZ](https://www.education.govt.nz/school/property-and-transport/projects-and-design/design/design-standards/designing-schools-in-aotearoa-new-zealand-dsnz-standards/) asks project teams to consider. These provide useful items to consider when evaluating what is practical for your project.

Environmental Design Strategies (excerpt from DSNZ)

|  |  |  |
| --- | --- | --- |
| Environmental Context and Factors: | * Ecology * Climate, Sun and Wind * Topography | * Geology and Hydrology * Natural Hazards * Natural Environment |
| Spatial Design: | * Orientation * Flexibility | * Adaptability * Resilience * Durability |
| Passive Design: | * Building material and systems * Natural Lighting and Shading * Natural Heating and Ventilation * Minimising Operational energy | * Minimising operational waste * Water conservation |

*Supporting documentation for Masterplan 50% is attached in* [*Appendix 3*](#_Appendices)Yes  No

### Summary of the Masterplan environmental design strategy options

<*write here>*

# Masterplanning – 100%

* 1. Preferred Environmental Design Strategies for the Masterplan

Provide a summary (not a full report) of:

* the preferred environmental design strategies to minimise whole of life carbon considered viable for your project’s Masterplan,
* any limitations due to constraints (e.g., site conditions).
* any identified innovative solutions to be considered

*Supporting documentation for Masterplan 100% is attached in* [*Appendix 4*](#_Appendices) *Yes*   *No*

### Summary of the preferred/ recommended Masterplan environmental design strategies

<*write here>*

# Preliminary Design - 50%

* 1. Summary of Key Building Elements Options Analysis

For this project stage, the focus is to compare the key building elements likely to have the greatest impact on whole of life emissions.

*Supporting documentation is attached in* [*Appendix 5*](#_Appendices) *Yes  No*

### Summary of Key Building Element Options:

Provide a summary list of the *substructure, superstructure* and *external envelope* building elements considered for option analysis during Preliminary Design 50%.

Building Elements Summary 50% PD

|  |  |  |
| --- | --- | --- |
| Elements | Summary List of Options | |
| Substructure | Foundations/ Substructure | * *Summary list of options here* |
| Earth retaining structures | * *Summary list of options here* |
| Superstructure | Ground floor structure | * *Summary list of options here* |
| Upper floor(s) structure | * *Summary list of options here* |
| Load bearing systems | * *Summary list of options here* |
| Roof structure | * *Summary list of options here* |
| Building Envelope | Cladding/ Façade (incl. openings) | * *Summary list of options here* |
| Roof system | * *Summary list of options here* |

### Limitations & Constraints

Provide commentary on limitations and constraints that impacted the ability to propose low carbon options for any of the elements above.

<*write here>*

* 1. Detailed Option Analysis for Structure and Building Envelope Elements

In the tables below, provide:

* the building element options for *substructure, superstructure* and the *building envelope* that have been explored (or the one viable option if this is the case)
* the carbon associated with these options
* an elemental project cost as estimated by the project Quantity Surveyor (if available)
* a tick for the preferred (pref.) option for each building element option.

Below each table summarise the basis for selecting the preferred option, include comment on meeting [DSNZ](https://www.education.govt.nz/school/property-and-transport/projects-and-design/design/design-standards/designing-schools-in-aotearoa-new-zealand-dsnz-standards/) standards and any benefits or risks

Carbon optioneering is not required for building element options or categories that are not relevant to a project.

### Carbon Analysis for Foundations/ Substructure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Name* | *Description summary* |
| 2: *Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Earth Retaining Structures options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

*<write here>*

### Carbon Analysis for Ground Floor Structures options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Upper Floor Structure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

*<write here>*

### Carbon Analysis for Load Bearing Systems options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Roof Structure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

*<write here>*

### Carbon Analysis for Roof System options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Cladding / Façade (incl. openings) options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | *000* | *000* | *000* | *000* | *000* | *000* | *000* | *$000k* |  |
| 2: *Name* | *000* | *000* | *000* | *000* | *000* | *000* | *000* | *$000k* |  |

Supporting comments for preferred option

For this option include how the preferred option will impact other facets of the building including operational carbon (e.g., maintenance, operational costs, energy use, heating, cooling, lighting).

<*write here>*

# Preliminary Design - 100%

* 1. Summary of Finalised Structure and Building Envelope Selections

The focus of this stage is to undertake an LCA bringing together the preferred building elements to assess the overall emissions of the building. Key points for this stage are:

* [*Section 3.5*](#_Modelling_Assumptions) outlines the scope of materials to be included in the embodied carbon LCA assessment.
* At Preliminary Design, placeholder values are acceptable to be used in your LCA for *non-structural internal elements* and *building services*.
* If selections for *non-structural internal elements* are finalised, replace the placeholder value with actual element values. EPD data, if available, may be used as a comparison between element options instead of modelling carbon.
* If your project includes any *other significant* services, then you must add this embodied carbon value to the *Building Services* placeholder value.

*Supporting documentation is attached in* [*Appendix 6*](#_Appendices) *Yes  No*

### Summary List

List the finalised selections for building elements for structure and the *building envelope* in this table.

Building Element Summary 100% PD

|  |  |  |
| --- | --- | --- |
| Building System | Elements | Summary List |
| Substructure | Foundations/ Substructure | * *Preferred selection here* |
| Earth retaining structures | * *Preferred selection here* |
| Superstructure | Ground floor structure | * *Preferred selection here* |
| Upper floor(s) structure | * *Preferred selection here* |
| Load bearing systems | * *Preferred selection here* |
| Roof structure | * *Preferred selection here* |
| Building Envelope | Cladding/ Façade (incl. openings) | * *Preferred selection here* |
| Roof system | * *Preferred selection here* |

### Limitations & Constraints

Provide commentary on limitations and constraints that impacted the proposed carbon reductions.

<*write here>*

* 1. Calculating embodied carbon for non-structural and building service elements

At Preliminary Design it is acceptable to use placeholder values provided below. If you wish to undertake a final (draft) LCA and have project specific values, that is also acceptable.

### Embodied Carbon Values for Non-structural and Building Service Elements

Placeholder values for non-structural internal elements (or actual values if known)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e (module D and biogenic) | | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building System | A | B | C | Embodied Carbon | Biogenic Carbon | D | Embodied Carbon |
| Non-str. Internal Elements  kgCO2e/m2 GFA | 51 | 51 | 20 | 122 | 0 | -1 | 121 |
| Non-str. Internal Elements  kgCO2e Total  *(multiply GFA Total (m2) by value)* | 000 | 000 | 000 | 000 | 000 | 000 | 000 |

Placeholder values for building service elements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e (module D and biogenic) | | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building System | A | B | C | Embodied Carbon | Biogenic Carbon | D | Embodied Carbon |
| Building Services  kgCO2e/m2 GFA | 15 | 64 | 12 | 91 | 0 | -2 | 89 |
| Building Services  kgCO2e Total  *(multiply GFA Total (m2) by value)* | 000 | 000 | 000 | 000 | 000 | 000 | 000 |

* 1. Life Cycle Assessment Summary – Preliminary Embodied Carbon Results (GWP kgCO2e)

Please enter the LCA embodied carbon results into the tables below.

Enter the values for preferred options for:

* *Substructure*
* *Superstructure*
* *Building envelope*

Enter the most accurate values for *Non-Structural Internal Elements* and *Building Services*. These are either:

* the totalled placeholder values, or
* project-specific values for preferred selections

Preliminary Design LCA Summary table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e (module D and biogenic) | | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building System | **A** | **B** | **C** | Embodied Carbon | Biogenic Carbon | **D** | Embodied Carbon |
|  |  |  |  |  |  |  |  |
| Substructure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Superstructure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Envelope | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Non-str. Internal Elements | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Services | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Total | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Total + 10% Contingency\* | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Per m2 (GFA Total) | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Per m2 (GFA Total) + 10%\* | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| MoE Carbon Target | Meets target?  Yes  No | | | **500** |  | | |

*\* For this 100% Preliminary Design Assessment, please also report the carbon (total and per m2) with a 10% contingency added to account for extra items (such as fixings) which may not have been accounted for at this stage.*

### Conclusion

Provide commentary on:

* how the project is tracking towards Ministry Carbon Targets
* any limitations and steps that are being taken.

<*write here>*

* 1. Life Cycle Assessment: Embodied Carbon Results (Graphed)

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across building system categories. Please note that Non-Structural Internal Elements and Building Services are based on placeholder carbon intensities at this stage.

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across the life cycle stages.

* 1. Summary of Potential Operational Efficiency Strategies

Provide a summary of environmental design strategies that could be used to improve operational efficiency. Refer to DSNZ and the table below as a useful starting point. At this stage we are looking for a written summary, not necessarily energy modelling results.

[Environmental Design Strategies (adapted from DSNZ)](https://www.education.govt.nz/school/property-and-transport/projects-and-design/design/design-standards/designing-schools-in-aotearoa-new-zealand-dsnz-standards/)

|  |  |  |
| --- | --- | --- |
| Environmental Context and Factors: | * irrigation * Climate, Sun and Wind * Topography | * Native planting * Natural Environment |
| Spatial Design: | * Flexibility * Adaptability | * Resilience * Durability |
| Passive Design: | * Building material and systems * Natural Lighting and Shading * Natural Heating and Ventilation * Minimising Operational energy | * Minimising operational waste * Water conservation * Minimise harmful substances |
| Supplementary Active Design: | * Ease of maintenance | * Low whole of life costs and carbon |

### Summary

<*write here>*

# Developed Design – 50%

* 1. Summary of Optioneered Building Elements

For this stage of the project, the focus is to:

* finalise selections of the *substructure, superstructure and the building envelope,* and
* compare options for *non-structural internal elements,* and
* account for *building services* with use of the placeholder values plus compare ‘add-on’ selections or use project specific data if known.

Reporting in this section may not be required if the 100% Preliminary Design accurately reports embodied carbon. i.e. if the project-specific values for *non-structural internal elements* and *building services* were used at 100% Preliminary Design. This needs to be confirmed with the Ministry Delivery Manager.

*Supporting documentation is attached in* [*Appendix 7*](#_Appendices) *Yes  No*

### Summary List:

Provide a summary list of:

* the finalised selections for key building elements, and
* options considered for *non-structural internal elements* and *building services*.

Building Element Summary 50% DD

| Building System | Elements | Summary List |
| --- | --- | --- |
| Substructure | Foundations/ Substructure | * *Finalised selection here* |
| Earth retaining structures | * *Finalised selection here* |
| Superstructure | Ground floor structure | * *Finalised selection here* |
| Upper floor(s) structure | * *Finalised selection here* |
| Load bearing systems | * *Finalised selection here* |
| Roof structure | * *Finalised selection here* |
| Building Envelope | Cladding/ Façade (incl. openings) | * *Finalised selection here* |
| Roof system | * *Finalised selection here* |
| Non-Structural Internal Elements | Internal floor finishes | * *Summary list of options here* |
| Internal non-loadbearing walls | * *Summary list of options here* |
| Internal wall finishes | * *Summary list of options here* |
| Internal doors | * *Summary list of options here* |
| Ceilings \* | * *Summary list of options here* |
| Building Services | HVAC Equipment | * *Summary list of options here* |
| Lifts and escalators | * *Summary list of options* |
| Other Significant | * *Summary list of options* |

### Limitations & Constraints

Provide commentary on limitations and constraints that impacted the proposed carbon reductions.

<*write here>*

* 1. Updated Embodied Carbon Results

Provide updated carbon results for the finalised key building elements selections, and an approximate cost as estimated by the Quantity Surveyor if available.

### Carbon Results for Foundations/ Substructure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Earth Retaining Structures options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Ground Floor Structures options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Upper Floor Substructure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Load Bearing Systems Structures options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Roof Structure options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Cladding / Façade (incl. opening) options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

### Carbon Results for Roof System options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| *1: Finalised Selection* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
| *1: Finalised Selection* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

* 1. Embodied Carbon Analysis Results

In the tables below, provide:

* the *non-structural internal elements* that have been explored
* the carbon associated with these options
* an elemental cost as estimated by the project Quantity Surveyor (if available)
* a tick for the preferred (pref.) option for each building element option.

EPD data, if available, may be used as a comparison between element options instead of modelling carbon.

Analysis is not required for building element options or categories that are not relevant to a project.

### Carbon Analysis for Internal Floor Finish options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Internal non-loadbearing walls options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Internal Wall Finish options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Internal Door options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

### Carbon Analysis for Ceiling options: (GWP kgCO2e)

|  |  |
| --- | --- |
| Building Element Options | |
| 1: *Option Name* | *Description summary* |
| 2: *Option Name* | *Description summary* |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e  (module D and biogenic) | | |  | |
| Today | Future | | **Total** (Gross) | Biogenic | Benefits | **Total** (Net) |
| Building Element Options | **A** | **B** | **C** | **Embodied Carbon** | **Biogenic**  **Carbon** | **D** | **Embodied Carbon** | **Cost $** | **Pref.** |
|  |  |  |  |  |  |  |  |  |  |
| 1: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |
| 2: *Name* | 000 | 000 | 000 | 000 | 000 | 000 | 000 | $000k |  |

Supporting comments for preferred option

<*write here>*

# Developed Design – 100%

* 1. Life Cycle Assessment Summary: Finalised Building Element Selections

At this stage of the project, the focus is to bring together the finalised selections for all *building systems* and assess the overall emissions of the building.

*Supporting documentation is attached in* [*Appendix 8*](#_Appendices) *Yes  No*

### Summary List:

List the final proposed building elements in the table.

Building Element Summary 100% DD

| Building System | Elements | Summary List |
| --- | --- | --- |
| Groundwork / Foundations  (i.e. Substructure) | Foundations/ Substructure | * *Finalised selection here* |
| Earth retaining structures | * *Finalised selection here* |
| Structure  (i.e. Superstructure) | Ground floor structure | * *Finalised selection here* |
| Upper floor(s) structure | * *Finalised selection here* |
| Load bearing systems | * *Finalised selection here* |
| Roof structure | * *Finalised selection here* |
| Building Envelope | Cladding/ Façade (incl. openings) | * *Finalised selection here* |
| Roof system | * *Finalised selection here* |
| Non-Structural Internal Elements | Internal floor finishes | * *Finalised selection here* |
| Internal non-loadbearing walls | * *Finalised selection here* |
| Internal wall finishes | * *Finalised selection here* |
| Internal doors | * *Finalised selection here* |
| Ceilings \* | * *Finalised selection here* |
| Building Services | HVAC equipment | * *Finalised selection here* |
| Lifts and escalators \*\* | * *Finalised selection here* |
| Other significant | * *Finalised selection here* |

### Limitations & Constraints

Provide commentary on limitations and constraints that impacted the proposed carbon reductions.

<*write here>*

* 1. Life Cycle Assessment Summary: Embodied Carbon Results (GWP kgCO2e)

Please complete the following embodied carbon results below. Enter the values for finalised selection for:

* *Substructure*, *superstructure* and the *building* *envelope*, and
* *non-structural internal elements*.

Enter the adapted placeholder values provided for Building Services. Include:

* The provided *Building Services* placeholder value, plus finalised selections for
* Embodied carbon data for:
  + *Any other significant service or*
  + Project specific data if known

Life Cycle Assessment Summary

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e (module D and biogenic) | | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building System | **A** | **B** | **C** | Embodied Carbon | Biogenic Carbon | **D** | Embodied Carbon |
|  |  |  |  |  |  |  |  |
| Groundwork / Substructure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Structure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Envelope | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Non-str. Internal Elements | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Services | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Total | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Total + 10% Contingency\* | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Per m2 (GFA Total) | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Per m2 (GFA Total) + 10%\* | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| MoE Carbon Target | Meets target?  Yes ☐ No ☐ | | | **500** |  | | |

### Conclusion

Provide commentary on how the project is tracking towards the Ministry Carbon Targets, highlighting in particular any limitation and constraints.

<*write here>*

* 1. Life Cycle Assessment: Embodied Carbon Results (Graphed)

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across building system categories.

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across the life cycle stages.

* 1. Summary of Preferred Operational Efficiency Strategies

Provide an updated summary of the preferred environmental design strategies that have been used to increase operational efficiency and lower operational carbon. [DSNZ](https://www.education.govt.nz/school/property-and-transport/projects-and-design/design/design-standards/designing-schools-in-aotearoa-new-zealand-dsnz-standards/) provides a useful starting point. We are looking for a brief written summary of strategies.

Environmental Design Strategies (adapted from DSNZ)

|  |  |  |
| --- | --- | --- |
| Environmental Context and Factors: | * Ecology * Climate, Sun and Wind * Typography | * Geology and Hydrology * Natural Hazards |
| Spatial Design: | * Orientation * Programme * Flexibility | * Adaptability, Resilience, Durability |
| Passive Design: | * Building material and systems * Natural Lighting and Shading * Natural Heating and Ventilation * Minimising Operational energy | * Minimising operational waste * Water conservation * Minimise harmful substances |
| Supplementary Active Design: | * Ease of maintenance | * Low whole of life costs and carbon |

### Summary

<*write here>*

* 1. Energy Modelling (Optional)

Refer to [*Section 3.4*](#_Modelling_Assumptions) for assumptions to be used for energy modelling. Record the energy use intensity in the tables below, red text requires data input.

Modelling operational energy could be used to justify increases in embodied carbon where the overall life cycle carbon emissions are reduced.

|  |  |
| --- | --- |
| Energy Use Intensity | |
|  |  |
| Total (kW.hr/yr) | 000 |
| Per GFA m2 (kW.hr/m2/yr) | 00 |
|  |  |
| MoE Carbon Target  (kW.hr/m2/yr) | TBC |

* 1. Operational Carbon Results (Optional)

Please complete the following operational carbon results below, red text requires data input.

Climate Change – (GWP kgCO2e)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B6 |  | B7 |  | Total (B6-B7) |  |
|  |  |  |  |  |  |  |
| Operational Use | 000 |  | MNA\* |  | MNA\* |  |
|  |  |  |  |  |  |  |
| Total | 000 |  | MNA\* |  | MNA\* |  |
| Per m2 (GFA Total) | 000 |  | MNA\* |  | MNA\* |  |
| MoE Carbon Target (m2) | TBC |  | TBC |  | TBC |  |

\*MNA – Module not assessed. This is for future inclusion as water data becomes increasingly available.

* 1. Life Cycle Assessment – Whole-of-Life Results (Graphed)

The following charts show embodied carbon (Gross) and operational carbon per m2 GFA Total (kgCO2e/m2).

# As Built

* 1. Summary of Materials Used in Construction

Please select the following Building System Elements used on in the table below (multiple selections are permitted). This information will be used for future benchmarking.

To facilitate future research, please also append all supporting documentation, including:

* quantity of schedules,
* emission factors and
* energy modelling data used in this LCA.

*Supporting documentation is attached in* [*Appendix 9*](#_Appendices) *Yes  No*

As-Built Building Elements

| Building System | Elements | Project Specified Element | |
| --- | --- | --- | --- |
| Groundwork / Foundations  (i.e. Substructure) | Substructure/foundations | Concrete ground beams  Concrete piles  Concrete perimeter footing | Raft  Timber piles  Other (please specify) |
| Earth retaining structures | Yes | No |
| Basements | Yes | No |
| Structure  (i.e. Superstructure) | Ground floor structure | Concrete slab  Timber floor structure | Other (please specify) |
| Upper floor(s) structure | Concrete  Timber | Combination |
| Load bearing systems: gravity/ lateral structural frames and walls | Steel frame  Concrete frame  Mass timber frame (LVL or Glulam) | Concrete shear walls  CLT shear walls  Framed wall, braced with sheet lining |
| Roof structure | Steel DHS purlins  Timber purlins  Steel truss  Timber truss | Steel rafter  Timber rafter  Steel cable bracing  Other (please specify) |
| Building Envelope | Cladding/ Façade – Whole element (includes insulation, int. finishes) | Curtain Wall Cladding  Timber Cladding  Flat Sheet Cladding  Prefinished Metal Cladding  Metal Profiled Sheet Clad | Masonry Veneer Clad  Fibre cement soffit  Plywood soffit  High pressure laminate soffit  Other (please specify) |
| Roof system (includes covering and insulation) | Profiled metal cold roof  Membrane roofing  Tiles  SIPs panel | Built-up metal warm roof  Built-up membrane warm roof  Other (please specify) |
| External windows and doors | Timber framed windows  Aluminium framed windows  Single glazed  Double glazed  Thermally broken  Glass coating (please specify)  Tinted glass  Trickle vents in window suites | Timber solid core door  Glazed door  Aluminium door  Garage/ steel roller door  Louvres/ grilles  Sun shading devices  BMS window controls  Other (please specify) |
| Non-structural internal elements | Internal non-loadbearing walls | Timber framed partitions | Steel framed partitions |
| Internal floor finishes | Carpet tiles  Carpet broadloom  Flotex carpet  Vinyl  Marmoleum | Polished Concrete  Tiles  Strandboard flooring  Hardwood sports floor  Other (please specify) |
| Building services | HVAC equipment | Heat pump (specify quantity)  Central boiler and radiators (specify boiler type if known)  Central air conditioning  Electric radiant panel heaters | Refrigerant in HVAC system (please specify)  Passively ventilated  WC electric ventilation  WC passive ventilation  Other (please specify) |
| Lifts and Escalators | Lift | Escalator |
| Other Significant | PV  Solar hot water | Rainwater collection (not on town water supply)  Rainwater collection (on town water supply)  Other (please specify) |

* 1. As-Built Life Cycle Assessment Update: Embodied Carbon Results (GWP kgCO2e)

If there are material changes in the project between the Design stage LCA and As-built, please complete the following embodied carbon results below. Enter the values for finalised selections.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gross Emissions kgCO2e  (excl. module D and biogenic) | | | | Potential Removals kgCO2e (module D and biogenic) | | |
| Today | Future | | Total (Gross) | Biogenic | Benefits | Total (Net) |
| Building System | **A** | **B** | **C** | Embodied Carbon | Biogenic Carbon | **D** | Embodied Carbon |
|  |  |  |  |  |  |  |  |
| Groundwork / Substructure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Structure | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Envelope | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Non-str. Internal Elements | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| Building Services | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
|  |  |  |  |  |  |  |  |
| Total | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Per m2 (GFA Total) | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| MoE Carbon Target | Meets target?  Yes ☐ No ☐ | | | **500** |  | | |

### Conclusion

Provide commentary on how the project tracked towards the Ministry Carbon Targets, highlighting in particular any limitation and constraints.

<*write here>*

* 1. As-Built Life Cycle Assessment: Embodied Carbon Results (Graphed)

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across building system categories.

The following chart shows embodied carbon (Gross) per m2 GFA Total (kgCO2e/m2) across the life cycle stages.

* 1. Energy Modelling (Optional)

Refer to [*Section 3.4*](#_Modelling_Assumptions) for assumptions to be used for energy modelling. Record the energy use intensity in the tables below, red text requires data input.

|  |  |
| --- | --- |
| Energy Use Intensity | |
|  |  |
| Total (kW.hr/yr) | 000 |
| Per GFA m2 (kW.hr/m2/yr) | 00 |
|  |  |
| MoE Carbon Target  (kW.hr/m2/yr) | TBC |

* 1. Operational Carbon Results (Optional)

Please complete the following operational carbon results below, red text requires data input.

Climate Change – (GWP kgCO2e)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B6 |  | B7 |  | Total (B6-B7) |  |
|  |  |  |  |  |  |  |
| Operational Use | 000 |  | MNA\* |  | MNA\* |  |
|  |  |  |  |  |  |  |
| Total | 000 |  | MNA\* |  | MNA\* |  |
| Per m2 (GFA Total) | 000 |  | MNA\* |  | MNA\* |  |
| MoE Carbon Target (m2) | TBC |  | TBC |  | TBC |  |

\*MNA – Module not assessed. This is for future inclusion as water data becomes increasingly available.

* 1. Life Cycle Assessment: Whole-of-Life Results (Graphed)

The following charts show embodied carbon (Gross) and operational carbon per m2 GFA Total (kgCO2e/m2).

# Appendices

Appendix 1: Building System Elements Categorisation: Detailed list of LCA inclusions and exclusions for each category

Refer to the table below for a description of Building System Elements categorisation, scope, and level of detail to be used during life cycle analyses. Elements for inclusion are not limited to those noted in the ‘Include’ column – these are examples of the type of scope and level of detail that is expected, and common elements that may be ambiguous with categorisation.

Building System Elements Categorisation: Detailed list of inclusions and exclusions

| category | Elements | Include | Exclude |
| --- | --- | --- | --- |
| Groundwork / Foundations  (i.e. Substructure) | Foundations/ Substructure | * Products below the underside of the ground floor slab * Foundations * Hardfilling * Piles * Damp proof membrane * Steel reinforcing bar | * Formwork * Fixings * External hard landscaping surfaces and substructures outside building perimeter * External services, including drainage |
| Earth retaining structures | * Retaining walls | * Temporary scaffolding * External hard landscaping retaining walls outside building perimeter |
| Basements | * Excavation * Basement walls | * Temporary scaffolding |
| Structure  (i.e. Superstructure) | Ground floor structure | * Ground floor structure (slab, joists etc) * Steel reinforcing bar in concrete slab * Damp proof membrane * Concrete nibs (e.g. building perimeter, or in wet areas) | * Foundations * Substructure * Formwork * Temporary scaffolding * Floor finishes * External hard landscaping surfaces outside building perimeter (e.g. pavers) |
| Upper floor(s) structure | * Upper floor structures (slab, double tees, joists etc.) * Upper floor verandah structure * Concrete nibs (e.g. building perimeter, or in wet areas) | * Formwork * Temporary scaffolding * Floor finishes |
| Load bearing systems | * Gravity and lateral structural frames * Columns and beams * Steel reinforcing bar in concrete columns * Load bearing walls * Secondary structure (e.g. stair stringers) * Steel flitch connections (for LVL and CLT) * Intumescent paint * Paint finish to structure | * Fixings (e.g. nails, screws, nail plates, bolts) * Formwork * Plasterboard or paint finish to load bearing walls * External wall studs * External wall rigid air barrier |
| Roof structure | * Rafters * Purlins * Steel cable bracing * Steel angles | * Fixings (e.g. nails, screws, nail plates, bolts) * Roof covering * Roof insulation * Roof internal finishes |
| Stairs \* | * Primary stair flight (concrete, timber etc.) * Steel reinforcing bar in concrete * Landings | * Fixings (e.g. nails, screws, nail plates, bolts) * Handrails * Balustrades * Stair floor finish (e.g. carpet) * Supporting structure (e.g. steel stringers, columns and beams) |
| Building Envelope | Cladding/ Façade (incl. openings) | * Paint finish to cladding if applicable * Cladding layer * Rigid air barrier * Membrane * Wall framing (studs, top and bottom plate, nogs) * Insulation * Internal plasterboard layer * Curtain wall & mullions * Soffits * Openable external windows * External door leaf (slid core, hollowcore, glazed etc.) * Paint finish to door leaf (undercoat, primer, top coat) * Door jamb (timber, aluminium) * External louvres/ grilles | * Fixings (e.g. nails, screws, nail plates, bolts) * Cladding/ Façade secondary elements (seals, brackets) * Flashings * Scotias * Internal paint finish * External windows and doors * Skylights * Fixed curtain wall panels * Curtain wall mullions * Door hardware * Door security (e.g. emergency break glass, request exit buttons, card readers) * Window security and hardware * Curtains/ blinds |
| Roof system | * Roof covering * Insulation * Membrane * Internal finishes * Rigid air barrier * Skylights | * Fixings (e.g. nails, screws, nail plates, bolts) * Rafters * Purlins * Fall protection systems * Photovoltaic array * Gutters * Downpipes * Flashings * Monkeytoe platforms |
| Non-structural Internal Elements | Non-loadbearing walls | * Wall framing (studs, top and bottom plate, nogs) * Wall lining (e.g. plasterboard) * Insulation * Bulkheads * Timber batten screening * Balustrades * Handrails | * Fixings (e.g. nails, screws, nail plates, bolts) * Paint finishes * Wall coverings (e.g. Autex) * Decorative boards/ panels * Acoustic clips * Sealant (fire rated around penetrations) |
| Internal floor finishes | * Floor finish (carpet, vinyl, marmoleum, tiles etc) * Adhesive/ glue * Grout * Concrete grind and polish | * Fixings (e.g. nails, screws, nail plates, bolts) * Floor structure i.e. slab or joists * Floor finish underlay * Skirting * Tactile indicators * Stair nosings |
| Internal wall finishes | * Paint finishes (undercoat, primer, top coat) * Wall coverings (e.g. Autex) * Plywood (if exposed finish) * Decorative board/ panel * Bathroom finishes (wall tiles, seratone panels) | * Fixings (e.g. nails, screws, nail plates, bolts) * Plasterboard * Skirting * Cornices * Angles to exposed edges of wall coverings e.g. Autex * Timber batten screening * Balustrades * Handrails * Curtains/ blinds |
| Internal doors | * Door leaf (solid core, hollowcore, glazed etc) * Paint finish to door leaf (undercoat, primer, top coat) * Door jamb (timber, aluminium) | * Door hardware * Door security (e.g. emergency break glass, request exit buttons, card readers) * Lintels above doorway |
| Ceilings \* | * Plasterboard and finishes * Ceiling tiles * Primary suspension grid system * Timber framing | * Fixings (e.g. nails, screws, nail plates, bolts) * Edge trim * Acoustic clips * Sealants |
| Building Services | HVAC equipment | * HVAC * Refrigerants | * Water * Drainage * Electrical services * Other building systems e.g. fire and security systems |
| Lifts and Escalators \*\* | * Lifts (housing and passenger car) * Escalators * Refer BRANZ CO2NSTRUCT for carbon data on lifts | * Lift structure i.e. steel columns or beams on lift shaft perimeter * Lift perimeter walls |
| Other Significant | * Photovoltaic array * Solar hot water * Rainwater collection (not on town water supply) * Rainwater collection (on town water supply) * Other (please specify) |  |

\* The MBIE Embodied Carbon Technical Methodology states these elements are ‘voluntary’ for reporting. For Ministry LCA reports, these items are mandatory for inclusion due to their impact on overall emissions.

\*\* The MBIE Embodied Carbon Technical Methodology states these elements as ‘voluntary’ for reporting. For Ministry LCA reports, these items are mandatory for inclusion due to their impact on embodied and operational emissions. At the time of writing, MBIE has categorised this item as ‘Structure’, but for consistency with the Climate Bonds Initiative (CBI) classification it has been re-categorised as a ‘Building Services’ item for Ministry LCA reports.

Appendix 2: Glossary

Refer to the table below for definitions of common terms used throughout this report.

Glossary

| Term | Definition | Source |
| --- | --- | --- |
| Biogenic Carbon | Biogenic carbon involves biological sources such as trees, plants and soil. In a carbon cycle, trees capture CO2 from the atmosphere during photosynthesis and store it. The carbon that has been sequestered in this way is released at a later stage when timber is burned or rots away. Because timber stores carbon, assuming it comes from sustainable forests (replanted after harvest), it has a low carbon footprint as a house material. | BRANZ |
| Carbon Dioxide equivalent (or CO2eq) | A measure of the global warming caused by all greenhouse gases released by a specific activity. In addition to Carbon Dioxide (CO2), it includes the impacts of other greenhouse gases, which are typically less significant than the impact of CO2, but are included for completeness. | MBIE, 2020 |
| Carbon Emissions | A shorthand term for emissions of all greenhouse gases, CO2 and others, which cause global warming. | MBIE, 2020 |
| • Emissions caused by non-renewable energy use, at all life cycle stages (any modules in A, B, C or D).  • Emissions caused by processes that emit greenhouse gasses, at all life cycle stages (any modules in A, B, C or D). | MBIE, 2022 |
| Carbon Footprint | A measure of the carbon emissions derived from a Life Cycle Assessment  (LCA) study, reported in the impact category of climate change or Global Warming Potential (GWP), measured in CO2e. | MBIE, 2020 |
| Carbon Removals | • Use of natural materials that store sequestered carbon that has been removed from the atmosphere by organic growth (module A1).  • Carbonation of concrete during the building’s lifetime (module B1).  • Potential benefits that may be realised by recycling material after end-of-life, avoiding future emissions from the use of virgin material (module D). | MBIE, 2022 |
| Co-Ordinated Building Information (CBI) | CBI (Co-ordinated Building Information) is a classification system designed by and for members of the construction industry, to co-ordinate the five main information sources: drawings; specifications; quantities; technical and research information; trade information and publications. | Masterspec,  2022 |
| Embodied Carbon | A shorthand term for whole-of-life embodied carbon. For construction materials or products, this is the amount of carbon emissions released throughout their supply chains, including raw material extraction and transportation, manufacturing process, construction site activities and material losses, repair, maintenance and replacement, as well as the end-of-life processing. For a building, the embodied carbon is the sum of the embodied carbon of all the constituent materials or products within the building. | MBIE, 2020 |
| Embodied Carbon (Gross) | *Embodied Carbon* excluding *Carbon Removals* (module D and biogenic carbon) | MoE, 2022 |
| Environmental Product Declaration (EPD) | This is a third-party verified report of Life Cycle Assessment (LCA) results for a construction material product or material. It uses ISO and often also EN standards. It documents the actual environmental performance of the product or material across a number of impact categories, including embodied carbon, usually reported under ‘Global Warming Potential’ (GWP) in units of kg CO2e. | MBIE, 2020 |
| Gross Floor Area (GFA) | The area enclosed by all the exterior walls of a building, measured to the external face of the external walls | DSNZ, 2022 |
| Gross Floor Area (GFA) Total | External area on floors and vertical circulation above ground level used for building access or outdoor learning. This includes external stairs, decking or ramps to ground and upper floors but not paved areas to the ground floor. | MoE, 2022 |
| Greenhouse Gases | Gases that trap heat in the earth’s atmosphere, contributing to global warming. The most prevalent ones are Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), and fluorinated gases (such as CFCs, HCFCs, HFCs etc. found in refrigerants). Of these, CO2 causes the largest warming impact. | MBIE, 2020 |
| Global Warming Potential (GWP) | The GWP of a gas indicates the contribution to global warming resulting from the emission of one unit of that gas compared to one unit of carbon dioxide (CO2), which has a value of 1. | BRANZ, 2022 |
| Life Cycle Assessment (LCA) | A method of assessing the environmental impacts associated with all stages of a product’s life, from raw material extraction to its processing, manufacture, distribution, use, repair, maintenance, and end of life treatment. | MBIE, 2020 |
| Net Floor Area (NFA) | Net floor area The occupiable/useable area within buildings such as teaching spaces, resource rooms, administration spaces, gyms, libraries, auditoriums, halls and multi-purpose spaces. | DSNZ, 2022 |
| Operational Carbon | Carbon emissions attributable to the operation of buildings. See the MBIE Transforming Operational Efficiency Framework. | MBIE, 2020 |
| School Property Guide (SPG) | The SPG is a calculator that determines how much area, in square metres, a school may need for teaching and non-teaching uses. Area is related to a school’s student roll | DSNZ, 2022 |

Appendix 3: Masterplanning 50% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 4: Masterplanning 100% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 5: Preliminary Design 50% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 6: Preliminary Design 100% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 7: Developed Design 50% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 8: Developed Design 100% - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery>

Appendix 9: As-Built - Supporting Documentation

<Include below any supporting documentation, eg. drawings, specifications, imagery. Please also attached the LCA data set.>

Appendix 10: Carbon Reduction Strategies (MBIE)

Below are carbon reduction strategies as described by MBIE (2020).

1. Maximise New Build Efficiency: ensure the size and quantity of new buildings are proportional to the need, upgrade existing buildings so they can be used effectively, and increase the longevity of new buildings and their components to reduce avoidable new build in the future.

|  |  |  |
| --- | --- | --- |
| Factor | Ways to reduce emissions | Source |
| Consider size of new buildings that will meet user needs | When developing the brief for a new building, consider the efficiency of the new building being proposed, and alternative ways to meet the end user’s needs. | MBIE, 2020 |
| Repurposing existing buildings/value of heritage | Make the use of existing buildings a viable alternative to building new, using retrofit or upgrade work if required. | MBIE, 2020 |
| Flexibility and Resilience | Ensure buildings will still be usable after earthquakes, the effects of climate change, and other potential changes over the design life, and are flexible enough to be adjusted with minimal impact if the user needs change, avoiding emissions from future rebuilds. | MBIE, 2022 |
| Building to last | Ensure building performance settings reflect the likely design life that can be achieved, enabling all the residual life of a building to be used. | MBIE, 2020 |

1. Increase building Material Efficiency: use less material in new buildings, including reducing waste and minimising replacement over the building’s life cycle.

| Factor | Ways to reduce emissions | Source |
| --- | --- | --- |
| Appropriate performance requirements | Stipulate realistic and reasonable performance requirements for the design of the building components to meet the end-user requirements.  Ensure excessive or multiple contingencies are not embedded in the design process. | MBIE, 2020 |
| The efficient use of materials by designers | Only specify as much material as required to meet performance requirements – and not more (lean design).  Consider material quantities at the concept design stage of a building, to ensure its form is conducive to high material efficiency. | MBIE, 2020 |
| Reduce construction waste | Reduce waste of materials in construction and upstream processes to minimise production to only as much as is required. This will reduce production and transportation emissions, as well as sector economic efficiency.  Apply manufacturing methodology to the supply chain for construction products. | MBIE, 2022 |
| Long lasting construction materials and products | Reuse construction materials and products in new buildings where they outlive the design life of their original building.  Design buildings for deconstruction to enable efficient recovery of components for reuse.  Consider a model of building owners ‘leasing’ construction materials and products, rather than buying them, enabling them to be used for other buildings in future with appropriate foresight. Embodied carbon emissions can therefore be shared across multiple buildings. | MBIE, 2020 |

1. Reduce the Carbon Intensity of the materials used in new buildings: either by making design choices to use low-carbon materials over high-carbon alternatives, and/or reducing the embodied carbon of the construction materials.

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| Factor | Ways to reduce emissions | Source |
| Reduce emissions from materials/products without affecting properties | Improve energy efficiency of production processes to reduce emissions, or substitute constituent parts of a construction product with low carbon alternatives (e.g. cement replacements).  Greater visibility and understanding of embodied carbon will encourage competition among manufacturers to do this. | MBIE, 2020 |
| Sourcing materials and products as close as possible to site | Reduce carbon emissions from transportation. | MBIE, 2020 |
| Increased use of low carbon materials | Use appropriate data and tools in the design process to highlight the benefits of low carbon alternatives to traditional materials and products, e.g. biobased or recycled/reused products. | MBIE, 2022 |



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