
Decarbonising Infrastructure Delivery

Guidance Note: Selecting Carbon Tools and Data
Sources

March 2025

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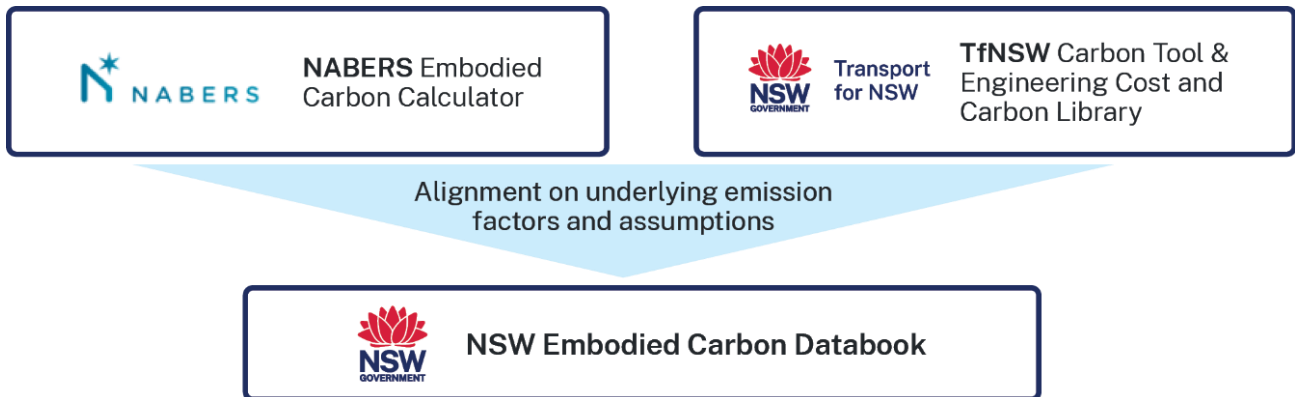
Section 1: Purpose of this guide

From April 2025, NSW Government projects within the scope of the *Decarbonising Infrastructure Delivery Policy* (Policy) are required to measure embodied carbon at the business case, planning approval, and construction stages. Embodied Carbon should be measured in line with the methodology in the *Embodied Carbon Measurement for Infrastructure: Technical Guidance* (Measurement Guidance).

Certain project types have additional policies and legislation guiding embodied carbon measurement. The *State Environmental Planning Policy (Sustainable Buildings) 2022* mandates that embodied emissions of NSW building developments be quantified to obtain development consent. Measurement must be in accordance with the National Australian Built Environment Rating System (NABERS) Embodied Carbon Calculator and measurement methodology. For transport projects, the application of Transport for NSW (TfNSW) tools is governed and managed separately by TfNSW’s project teams to support the *TfNSW Net Zero & Climate Change Policy*.

This guide directs project teams to the most appropriate measurement and management tool or database according to project type. The tools and databases listed have been aligned, with clear documentation on sources, to enable transparent and consistent carbon measurement and management.

Figure 1. Alignment process for embodied carbon measurement and management tools and databases.



Section 2: Selecting tools and data for your project

Selecting the carbon tool or methodology for your project

You should use the appropriate tool when measuring the embodied carbon of your project. There are 4 key tools for use on NSW Government projects (as shown in Table 1). Infrastructure NSW, NABERS and TfNSW have worked to align underlying common emission factors and assumptions, which will be incorporated into forthcoming tool updates. Note that some of the underlying data in each tool remain different, due to the unique scope, scale and purpose of each tool.

Table 1. Overview of tools available to NSW Government projects*

Tool	Asset type	Overview and reference documents
Transport for NSW Engineering Cost and Carbon Library (TfNSW ECCL) - forthcoming	Transport assets	<p>This tool includes cost and baseline carbon rates with consistent units of measurement and classification. The tool contains benchmark rates for approximately 5,000 resources (plant, labour, materials, fuels), items and assets. The tool has been pre-mapped to the Digital Engineering Framework, engineering standards, and ICMS3. It is currently being aligned to TfNSW's supply chain registers for carbon management.</p> <p>The TfNSW ECCL is expected to be released in Q2 2025 and adopted for use by TfNSW project development teams. It will be progressively rolled out for use by external contractors from 2026.</p>
TfNSW Carbon Tool	Transport assets	<p>This is a calculator for the measurement and management of carbon emissions during design phases and construction of TfNSW projects. This tool is provided to TfNSW project partners to complete.</p>
NABERS Embodied Carbon Calculator	Buildings	<p>This tool measures embodied carbon in new buildings and major refurbishments. Measurement must be in line with the Embodied Carbon Rules. The underlying emission factors and calculation assumptions for the tool are documented in the NABERS National Emission Factors Database. The NABERS Embodied Carbon Calculator is planned for release in April 2025.</p>
NSW Embodied Carbon Databook (ECD)	Other/mixed	<p>The ECD provides default emission factors, carbon intensity benchmarks and calculation assumptions to support carbon measurement in line with the Policy. The ECD provides inputs for carbon measurement where a project is not able to use the NABERS or TfNSW tools, enabling consistent measurement for all NSW Government project types.</p> <p>The ECD should be used in conjunction with the Measurement Guidance, which provides the methodology for selecting appropriate data and undertaking calculations.</p>

Note: *Sydney Metro and Sydney Water also have carbon estimation tools.

The data sources include:

- Australian National Lifecycle Inventory Database (AusLCI) and Shadow Database version 1.42¹
- Process-based data from the Integrated Carbon Metrics Embodied Carbon Life Cycle Inventory Database (ICM database)²
- Environmental Product Declarations (EPDs)
- The Inventory of Carbon and Energy (ICE) database v4.0³
- NABERS National Emission Factor Database⁴
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) National Greenhouse Account factors⁵
- Transport Authorities Greenhouse Group (TAGG) – Land clearing emission factors from Appendix E in *Greenhouse Gas Assessment Workbook for Road Projects*⁶
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) traNSIT Supply Chain Transport.⁷

Table 2 below outlines the tools or methodology to use for your project depending on project stage and type in the absence of product-specific information. As there can be multiple tools that apply at each stage, agency representatives from project teams should be consulted on which tool to use for specific projects.

Table 2. Primary tool depending on project stage and type (when product-specific information is unavailable)

INSW Measurement and Reporting Stages	Project type		
	TfNSW*	Buildings	Other/mixed**
Stage 1 – Business Case	<ul style="list-style-type: none"> • TfNSW Carbon Tool • NSW ECD 	<ul style="list-style-type: none"> • NABERS Embodied Carbon Calculator (where quantity data is available). • NSW ECD for projects with only cost or high-level physical characteristics (i.e. km, GFA or kW capacity) information. 	<ul style="list-style-type: none"> • NSW ECD
Stage 2 – Design and Planning Approvals	<ul style="list-style-type: none"> • TfNSW Carbon Tool 	<ul style="list-style-type: none"> • NABERS Embodied Carbon Calculator. 	<ul style="list-style-type: none"> • NSW ECD
Stage 3 – Construction and Practical Completion	<ul style="list-style-type: none"> • TfNSW Carbon Tool 	<ul style="list-style-type: none"> • NABERS Embodied Carbon Calculator. 	<ul style="list-style-type: none"> • NSW ECD

Notes:

*Sydney Metro has a similar Carbon Tool that should be used for Sydney Metro projects. The ECCL is not yet deployed across TfNSW projects or publicly available. Further guidance will be provided when it is released for use.

**Sydney Water has carbon estimation tools that can be used across the project lifecycle.

¹ Australian Life Cycle Assessment Society, *AusLCI (V1.42) Carbon Emissions Factors (Construction)* [data set], AusLCI website, 2023.

² T Wiedmanh, SH Teh, M Yu, G Chen, S Lundie, and S Moore, *ICM Database - Integrated Carbon Metrics Embodied Carbon Life Cycle Inventory Database* [data set], UNSW website, 2019.

³ Circular Ecology, *Inventory of Carbon and Energy (ICE) database v4.0* [data set], Circular Ecology website, 2024.

⁴ NABERS, *National emission factors database v1.0* [data set], NABERS website, 2024.

⁵ DCCEEW, *National Greenhouse Accounts Factors 2024* [data set], DCCEEW website, 2024.

⁶ TAGG, 'Appendix D Emission Factors', in *Greenhouse Gas Assessment Workbook for Road Projects*, AustStab website, 2013.

⁷ CSIRO, *Transport logistics-TraNSIT*, CSIRO website, n.d.

Selecting generic and industry-average datasets for your project

Transport for NSW projects

TfNSW projects involve a variety of asset types (e.g. roads, railways, maritime assets, warehouses, service facilities, and substations). TfNSW tools can be used to measure civil infrastructure and building components, however the NABERS methodology should be used for buildings where it is required by the Sustainable Buildings SEPP.

- **Stage 1 (Business Case):** At the business case stage, projects estimating embodied carbon without bills of quantity can use the asset and item-level carbon intensity benchmarks provided by the TfNSW ECCL (when available and where suitable data exists). There are also asset level carbon-intensity benchmarks in the NSW ECD and TfNSW Carbon Tool, which can be used when suitable quantity and item-level data are not available. Once projects have bills of quantity, they must use material-specific emission factor data and should use the TfNSW Carbon Tool. Guidance on which tool to use will be provided by TfNSW project teams.
- **Stages 2 (Design and Planning Approvals) and 3 (Construction and Practical Completion):** Once projects progress to design and planning approvals stages, projects must use material-specific emission factor data. Projects should use the TfNSW Carbon Tool. Guidance on which tool to use will be provided by TfNSW project teams.

Building projects

Building projects include social infrastructure such as schools, hospitals, art galleries, and buildings with commercial uses. Some infrastructure precincts include building components that should be measured in accordance with the NABERS methodology.

- **Stage 1 (Business Case):** At the business case stage, projects estimating embodied carbon without adequate quantity details available can use the asset-level carbon intensity benchmarks provided in the NSW ECD workbook.
- **Stage 2 (Design and Planning Approvals) and Stage 3 (Construction and Practical Completion):** Once projects have bills of quantity or have progressed to design and planning approvals stages, projects must use material-specific emission factor data. Projects with building components should use the NABERS Embodied Carbon Calculator, which provides industry-average data where project-specific and material-specific information is unavailable.

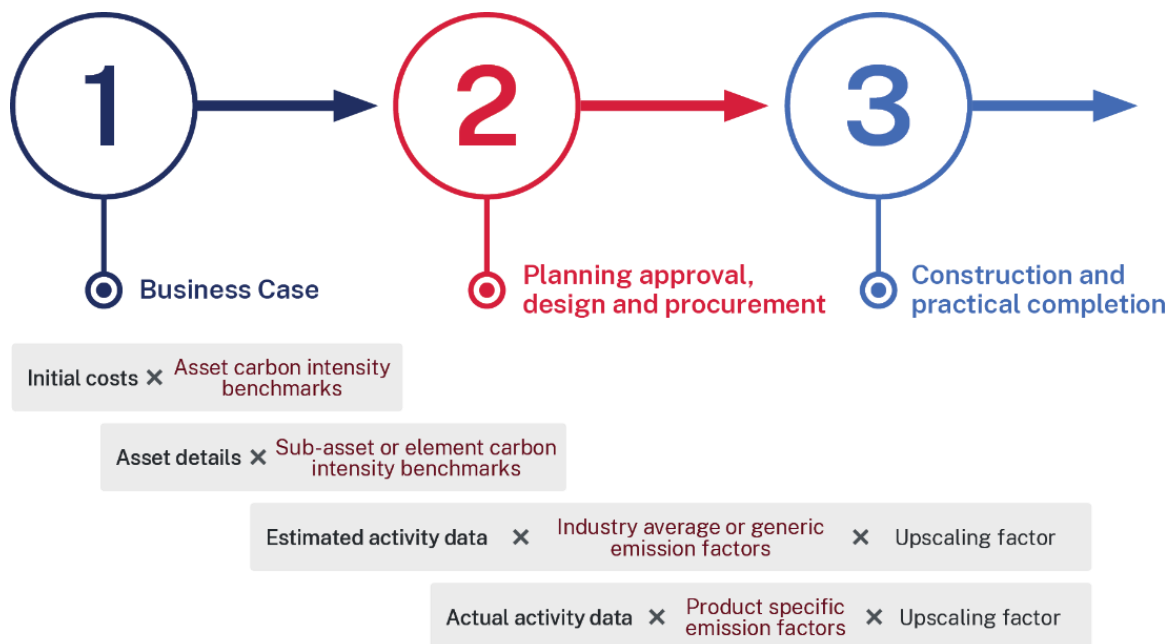
Other project types or projects with mixed asset types

- **All stages:** Other projects include dams and precincts with mixed asset types. These can use the NSW ECD workbook.

Selecting emission factor data in the NSW ECD

As discussed above, data suitability and availability changes over the lifecycle of the project. The NSW ECD allows for flexibility in selecting emission factors and benchmarks. It should be used in conjunction with the Measurement Guidance. In particular, the figure below summarises what calculation method to use as the project progresses and Section 5 of the Measurement Guidance provides further information.

Figure 2. Suitable emission calculation approaches at each project stage (from Measurement Guidance, Table 5.1, p. 16)



The NSW ECD acts as a directory to underlying industry average and generic emission factor data (as shown in Table 3 below). Where available, project teams should use other sources of product-specific emission factor data. The emission factor hierarchy below summarises which sources to preference as more detail becomes available to project teams. Note that this table supersedes Table 5.2 from the Measurement Guidance.

Table 3. Emission factor and carbon intensity benchmark hierarchy to be applied when calculating embodied carbon (updated from Measurement Guidance, Table 5.2, p 18)

Emission factor type and hierarchy	Supported data sources	
1 Product specific emission factor	<ul style="list-style-type: none"> Environmental Product Declaration (EPD) for specific products and suppliers Climate Active carbon footprint data 	<div style="display: flex; align-items: center; justify-content: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">More accurate and representative</div> <div style="width: 100%; border-left: 1px solid black; border-right: 1px solid black; height: 100%;"></div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Less accurate and representative</div> </div>
2 Industry average emission factor*	<ul style="list-style-type: none"> Australian National Greenhouse Account Factors Industry average EPD for a product type NABERS National Emission Factor Database TfNSW Engineering Cost in Carbon Library** TAGG – Land clearing emission factors from Appendix E in Greenhouse Gas Assessment Workbook for Road Projects** 	
3 Generic emission factor from database	<ul style="list-style-type: none"> TfNSW Carbon Tool and Sydney Metro Carbon Tool emission factors AusLCI 1.42 and Shadow Database ICM database (process-based data)** ICE v4.0** 	
4 Generic emission factor from global literature scan	<ul style="list-style-type: none"> Generic emission factors from global literature, where the worst value found for the product type should be used (only where above emission factor sources do not provide coverage) 	
5 Sub-asset or element level carbon intensity benchmark	<ul style="list-style-type: none"> There are currently no suitable published data sources available in Australia, and agencies and industry bodies are encouraged to develop benchmarks specific to asset types. 	
6 Asset level carbon intensity benchmark	<ul style="list-style-type: none"> Asset level carbon intensity benchmarks are provided in the NSW ECD Agencies and industry bodies are encouraged to further develop benchmarks specific to asset types. 	

Notes:

* The following source was removed from this category: Infrastructure Australia’s industry average emission factors from the Supporting Appendices of the Embodied Carbon Projections for Australian Infrastructure and Buildings.

** Source has been added to the table since the release of the Measurement Guidance.

Section 3: Navigating the NSW ECD workbook

A brief overview of each tab in the NSW ECD workbook is provided in the table below.

Table 4. Overview of NSW ECD structure and content.

Tab name	Description	Relevant reporting modules
1. Default emission factors		
1.1 Product Stage EFs	Default emission factors for the product stage	A1-A3
1.2 Transport EFs	Default emission factors for the transport stage	A4
1.3 Energy EFs	Default energy emission factors and associated fuel standard conversion factors	A5
1.4 Land use EFs	Default land use emission factors	A5
1.5 Waste treatment EFs	Waste treatment emission factors	A5 and C1-C4
1.6 Concrete EF calculator	Calculator to determine default concrete emission factors based on a known mix design	A1-A3
2. Asset-level carbon intensity benchmarks		
2.1 Benchmarks - physical unit	Emission intensities based on asset typecast unit where available (i.e. GFA and kW)	A1-A5
2.2 Benchmarks - material spend	Emission intensities based on material spend	A1-A5
3. Default calculation assumptions		
3.1 Transport Distances	Default transport distance assumptions for the transport of materials and waste	A4-A5
3.2 Wastage and EOL rates	Default assumptions for waste generation during construction and construction waste treatment assumptions	A4 and C1-C4

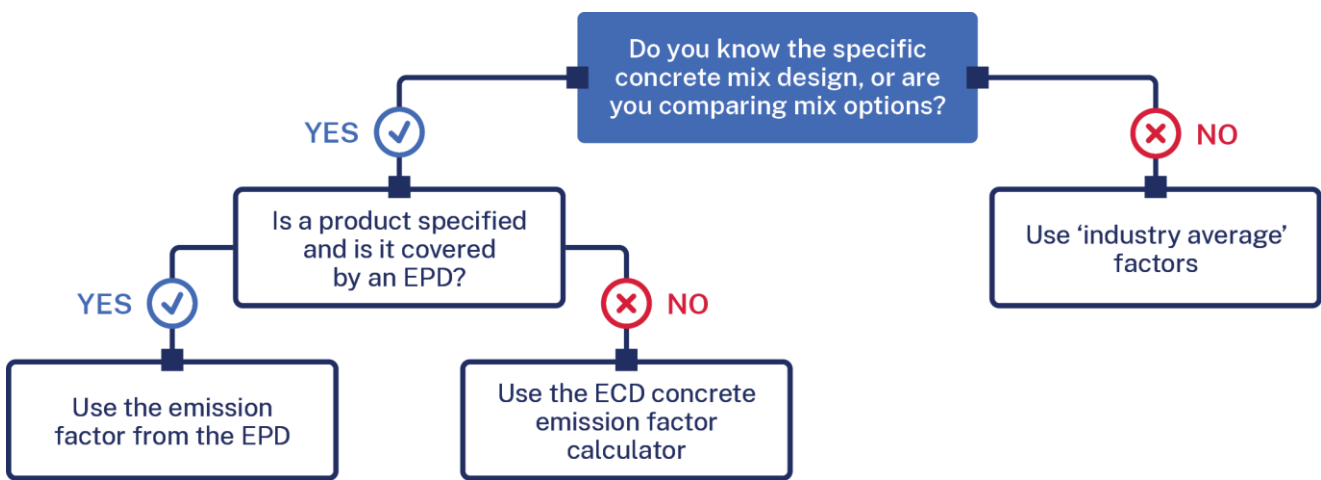
Section 4: Data management and update cycles

The NSW ECD and NABERS National Emission Factors Database will be updated annually. TfNSW, NABERS, and Infrastructure NSW will also coordinate updates to ensure continued alignment between respective datasets and tools. NSW Government will work together as carbon measurement maturity develops to expand and align on assumptions for other lifecycle modules.

Appendix A: Selecting concrete mix emission factors

For concrete emission factors, there are 3 main sources that project teams can use. Project teams should apply the emission factor hierarchy when selecting sources to preference. Figure 3 shows the decision process for selecting an approach and data sources for concrete mix emission factors. If a project team does not yet know the specific concrete mix designs that are likely to be used, the industry average emission factors provided in the NABERS, TfNSW, or ECD tools should be used. If the project team knows the mix design but the product does not have an EPD, or if concrete mix options are being compared, the ECD's concrete emission factor calculator should be used (tab 1.6).

Figure 3. Decision process to take selecting emissions factor data for concrete



Note that the concrete emission factor calculator is not appropriate for comparison with emission factors from product-specific EPDs, as data quality and background data are likely to differ. Care should also be taken when comparing between different supplier mix designs, which may have varying data quality and completeness e.g. if some admixtures are not provided in the mix design information.

To enable a consistent comparison of the emissions intensity of concrete mixes across ready-mix and precast uses, reinforcement (bars, fibres, etc) should be estimated separately using the appropriate factors from 1.1 Product Stage EFs sheet.

Where a supplier provides a range for the quantities of concrete mix components, the project team should take a conservative approach and use the upper ranges provided.

NSW ECD Concrete Emission Factor Calculator Methodology

The methodology used within the concrete emission factor calculator (tab 1.6 in the ECD) draws on background emission factor data and assumptions from the ECD. It aims to balance completeness and accuracy with ease of use and data availability limitations.

The calculator includes the impacts associated with raw material supply of concrete components (A1), upstream transport of concrete components to batching plants (A2), and concrete manufacturing (A3). The Construction Stage (A4 - A5) impacts from transporting the concrete to site and concrete placement (e.g. pumping) are not covered and must be accounted for separately

within the project's upfront carbon calculations. The methodology for each lifecycle module is summarised below:

Raw Material Supply (A1) - for each component, the user inputs a mass which is combined with the corresponding emission factor from the ECD (Tab 1.1). The sum of emissions from each component is the total A1 emissions for the concrete mix. Reinforcement is not included within the concrete calculator and must be included separately within the project's upfront carbon calculations.

Upstream transport of concrete components (A2) - the mass of each concrete component is multiplied with a default transportation distance for road, rail and sea (from Tab 3.1 of the ECD) and a corresponding transport emission factor (from Tab 1.2). The sum of emissions from transporting each component to the batch plant is the total A2 emissions for the concrete mix.

Concrete manufacturing process (A3) - default activity data (energy use, water use, waste quantities) for the batching process is applied using assumptions from AusLCI concrete process data, applying emission factors consistent with the ECD (Tabs 1.3 and 1.5). The sum of emissions from each activity at the batch plant is the total A3 emissions for the concrete mix.

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