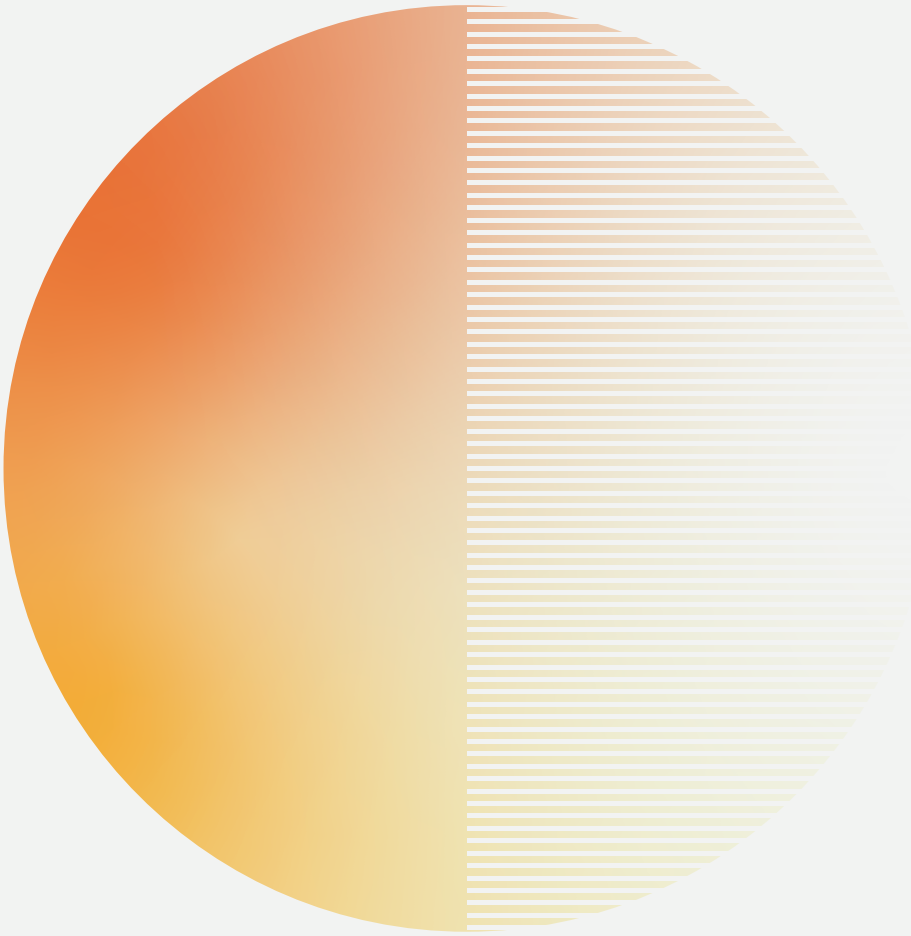
WBLCA Classification System



KPMB LAB

KPMB Architects + Integral Group
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Introduction

We are proposing a system for classifying whole building life cycle assessments by methodology. The system has four classifications: Class D through Class A. This paper outlines the four classification levels and the methodology each refers to. We have also produced a quick-reference chart outlining the key attributes the four classifications.

The primary intent of the proposed classification system is to reduce ambiguity around the particular methodology employed when discussing WBLCAs. Explicitly declaring WBCLA methodology has the advantage of communicating a range of information to practitioners familiar with WBLCAs, including breadth and type/quality of model inputs, magnitude of expected error in WBLCA, and appropriate uses of the WBLCA output.

Some practitioners may wish to use WBCLA in an iterative fashion to support and inform an architectural design process. Indeed, that is the primary mode for KPMB LAB. In these cases, the WBLCA classification implies a workflow that may be adopted in part or in whole. Starting with quick models using a small number of inputs (Class D) and progressing through iteratively more complex design-stage models (Class C and Class B), practitioners may choose to close the information loop on their WBLCA models with a construction phase ‘as-built’ WBLCA (Class A.) We have extended the classification definitions to include information about suitable project phases, resolution of model inputs and scale-appropriate CO2 reduction strategies for each of the classification levels.

WBLCA Methodology Classifications

CLASS	D	C	B	A
NAME	**Indicative Estimate**	**Assembly Estimate**	**Design Estimate**	**As - Built Model**
METHODOLOGY	Building area **x** typology-based estimates	Assembly definitions with GWPs **x** area of each assembly	Individual material and product quantities **x** material specific GWPs	Bills of lading for materials/products on construction site **x** EPDs for each product/material.
QUANTITIES	Building areas from RFP or concept model if available.	Assembly areas, from design model.	Quantity take-off from design model.	Bills of lading from construction site plus: -Construction Waste Haul Tickets -Utility/Fuel Bills for Site equipment (Crane/Bobcats/ Excavators/Site Office).
GWP DATASOURCE	Typology-based estimates	Assembly GWP estimates, National LCI Data, and generic global EPDs.	Blend of national Generic EPD's, National LCI Data, and Product Specific EPD's.	Factory specific EPDs.
TYPICAL TOOLS	• Excel • Athena Impact Estimator • Carbon Designer 3D tool by OneClick • EC3	• Excel • One Click LCA • Athena Impact Estimator • Cardinal LCA • Tally LCA	• BIM modelling software, e.g. Revit, ArchiCad, etc. • OneClick LCA • Tally LCA	• Excel • One Click LCA
SUITABLE PROJECT PHASES	All	Concept Design or SD through completion.	DD or CD through completion.	Construction phase through completion.

Supporting Characteristics

TYPICAL LEVEL OF RESOLUTION OF BUILDING INFOR-MATION	Foam block-style architectural massing model.	Schematic design with clear-wall assemblies defined at an outline spec level and a draft of the structural system designed.	Construction drawing phase BIM model or drawing set.	Issued For Construction drawing set; in-process As-Built drawing set; shop drawings.
BIM LOD LEVEL	Pre-BIM/100	100/200	300/350	400/500
LCA SCENARIOS	Left as Default.	Left as Default.	If available: - Service lives to match warrantied performance, -Transport distances to match distance from Factory to Site	Modifications: - Service lives to match warrantied performance, -Transport distances to match distance from Factory to Site -A5 Wastage %'s to match actual Haul Ticket data - C3 Waste Processing per local practice
CO2 REDUCTION STRATEGIES APPROPRIATELY SCALED TO THIS METHODOLOGY	“Right sizing” the building area for client programme.Examining building re-use as an option?Comparing impacts of various building massing options.Structural system selection. Examining impacts of sub-grade parking.	Evaluating assembly options.Material selection (as distinct from product selection.)Optimizing design of specific building systems for carbon reduction, e.g. optimizing cast-in-place concrete system with low carbon mix designs, longer re-shoring, etc.	Optimizing specific product and vendor selection and specification.Optimizing design of specific building systems for carbon reduction.	Minimize material waste and optimize recycling of construction waste.Requesting documentation of quantity of emissions associated with materials and products delivered to site can spur awareness and lead to broad up-take of reduction strategies.
EXPECTED ERROR	Wide error bars	Sorta-wide error bars	Narrow Error Bars	Error for building material quantities used should be zero. Error for total GWP would be weighted aggregate error of the individual EPDs.
B6 (OPERATIONAL GWP) DATA SOURCE	Code-defined GHGI limits	Initial Energy Model	Initial Energy Model	Utility Bills

CLASS D Indicative Estimate

A *Class D – Indicative Estimate* is the simplest form of WBCLA. Design model inputs in a Class D estimate are very rudimentary and may be as perfunctory as a building area provided in a client's programme document, or the basic geometry information available in simple foam-block architectural massing models.

A Class D estimate is useful for quickly assessing the emissions intensity of an entire project and for informing design choices at the building massing scale. For example, a Class D estimate could help a design team evaluate the emissions intensities of a range of building massing options; it could be used to estimate the carbon benefits of 'right sizing' a client's building program; it could be used to assess the avoided emissions of deleting sub-grade parking from a project, etc.

Material quantity estimates in a Class D WBLCA can be as simple as an estimate of the building GFA. Some tools (e.g. the Carbon Designer 3D tool by OneClick) allow for more dimensional inputs to produce a more tailored building model. Importantly, the actual geometry of the proposed building design need not be established to produce a Class D WBLCA.

GWP values for a Class D WBLCA will be generic values. There are several types of generic GWP values that may apply, including:

- Typology-based average embodied carbon intensity values provided by whole-building benchmarking studies;
- Generic material-specific GWPs from LCA databases;
- GWPs from industry average material-specific EPDs.

Class D WBLCAs do not typically contemplate product specific GWPs. If a practitioner wishes to include product specific GWP values in a Class D WBLCA, an explanation of why this is necessary would be appropriate.

A Class D estimate can be produced at any project stage.

Typical tools used to produce a Class D estimate may include:

- Excel
- Athena Impact Estimator
- Carbon Designer 3D tool by OneClick
- EC3

Expected error in a Class D estimate will be the largest of any of the classes.

CLASS C Assembly Estimate

A *Class C – Assembly Estimate* is the second simplest classification of WBLCA. In a Class C estimate, the proposed design being assessed has some established geometry and some proposed assemblies specified that can serve as inputs for the WBLCA model.

A Class C estimate is a useful tool for helping designers assess the impacts of material choices for the project and also to compare the emissions.

Material quantity estimates in a Class C WBLCA will be based on a proposed design that allows the practitioner to ascertain rough quantities. For example, the practitioner would measure area of façade assemblies, volumes of structural materials, etc. associated with various assemblies.

GWP values for a Class C WBLCA will typically be generic material values or benchmark values for specified assemblies. Class C WBLCAs do not typically contemplate product specific GWPs, as they contconcern material and assembly selection over particular product specification. RDH/TAF/Mantle Developments current Part 3 benchmark study in Toronto may provide useful assembly GWP values for future LCAs.

The current study *Embodied Carbon Metrics & Guidance for Building Envelope Design* undertaken by RDH Building Science, Toronto Metropolitan University and Mantle Developments may provide useful assembly GWP values for future WBLCA efforts.

A Class C estimate can be produced as soon as a sufficiently detailed project model is available, and at any point thereafter. Typically, such a model would be produced in the schematic design phase of a project.

Typical tools used to produce a Class C estimate may include:

- Excel
- One Click LCA
- Athena Impact Estimator
- Cardinal LCA
- Tally LCA

Expected error in a Class C estimate should be significantly lower than in a Class D estimate.

CLASS B Design Estimate

A *Class B – Design Estimate* is the most comprehensive design-stage WBLCA methodology. Several workflows could be employed to produce a Class B estimate, including linking a BIM model to a comprehensive GWP database (e.g. Revit model into OneClick LCA). Alternatively, practitioners could derive material and product quantities from construction or tender document sets, in a manner similar to a construction estimator or a quantity surveyor. In either case, the WBLCA is a product of accurate material and product quantities multiplied by specific GWP values.

A Class B estimate should provide the most accurate assessment of emissions associated with a proposed project during design. The Class B estimate is an appropriate tool for helping designers assess emissions impacts of specifying specific products for the project.

GWP values for a Class B WBLCA will typically be product-specific values derived from product-specific EPDs. Where these values are not available, industry average GWP values or indicative values from GWP databases can be used in place.

A Class B estimate can be produced as soon as a sufficiently detailed project model is available, and at any point thereafter. Typically, such a model would be produced in the design development or construction drawing phase of a project.

Typical tools used to produce a Class B estimate may include:

- BIM modelling software, e.g. Revit, ArchiCad, etc.
- OneClick LCA
- Tally LCA

Expected error in a Class B estimate should be the lowest of any design-stage WBLCA.

CLASS A As-Built WBLCA

A *Class A – As-Built WBLCA* is compiled by tracking material and product quantity and provenance information from the construction site and multiplying it by product-specific GWP values from product, or ideally, plant-specific EPDs. This model should evidence little to no error with respect to material and product quantities. (GWP values can be refined over time as better information becomes available.)

A Class A WBLCA can serve several functions. The Class A model closes the loop on the carbon model information flow, allowing practitioners to calibrate their design phase models (Classes D, C and B) with real-world information about material and product quantities, increasing the accuracy of design stage models over time. Perhaps more importantly, the Class A model provides a credible data set to focus our emissions-reduction efforts going forward. Developing a clear understanding of material and product quantities in built projects provides a clear basis for prioritizing emissions reductions efforts in future projects. It may also be the case in future scenarios that the Class A models would be used for documenting compliance with certification systems or regulation (akin to demonstrating waste reduction accomplishments on building projects today.)

Material quantity information in a Class A WBLCA will be collected from the building site in a process similar to that used to verify material waste diversion today: bills of lading, etc. are collected from relevant trades to ascertain material and product flows. Other inputs could include construction waste haul tickets, utility/ fuel bills for construction site equipment, etc.

GWP values for a Class A WBLCA will typically be product-specific values derived from product-specific, and ideally factory-specific EPDs. Where these values are not available, industry average GWP values or indicative values from GWP databases can be used in place.
A Class A WBLCA can only be produced during the construction phase of a project.

Typical tools used to produce a Class A estimate may include:

- OneClick LCA
- Excel

Expected error in a Class A estimate should be the lowest of any WBLCA.

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