SE 2050 Database User Guide

Version 1.0
October 1, 2025

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Introduction

The goal of this User Guide is to assist structural engineers and project team members in submitting project data to the SE 2050 Database as part of their SE 2050 Commitment. The Database is populated by users with inputs for Project Information and Embodied Carbon data which is reported as Global Warming Potential (GWP). This Guide provides a definition for each Database entry field accompanied by notes to the User.

Due to the complexity of project-specific data, it is acknowledged that not all projects will have the ability to follow this User Guide exactly. Users are encouraged to fill out the Database fields to the best of their ability while maintaining the "spirit" of the intended definition.

More detailed information about performing Life Cycle Assessments (LCA) is provided in the *Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings*, which was published on 4 September 2025. Users are encouraged to reference this document and the User Guide as they perform their Life Cycle Assessments and report data to the database. The SE 2050 Database allows users to easily update any project at any time when the design progresses or the LCA is refined.

SE 20250 Database User Guide

This document

- General information about the use of the SE 2050 Database
- Basic guidance on SE 2050 Database project input parameters

Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings

Released 4 September 2025

- Guidance on how materials should be quantified during building design and construction
- Guidance on how embodied carbon should be calculated and reported
- Define rules of comparison for structural systems based on embodied carbon

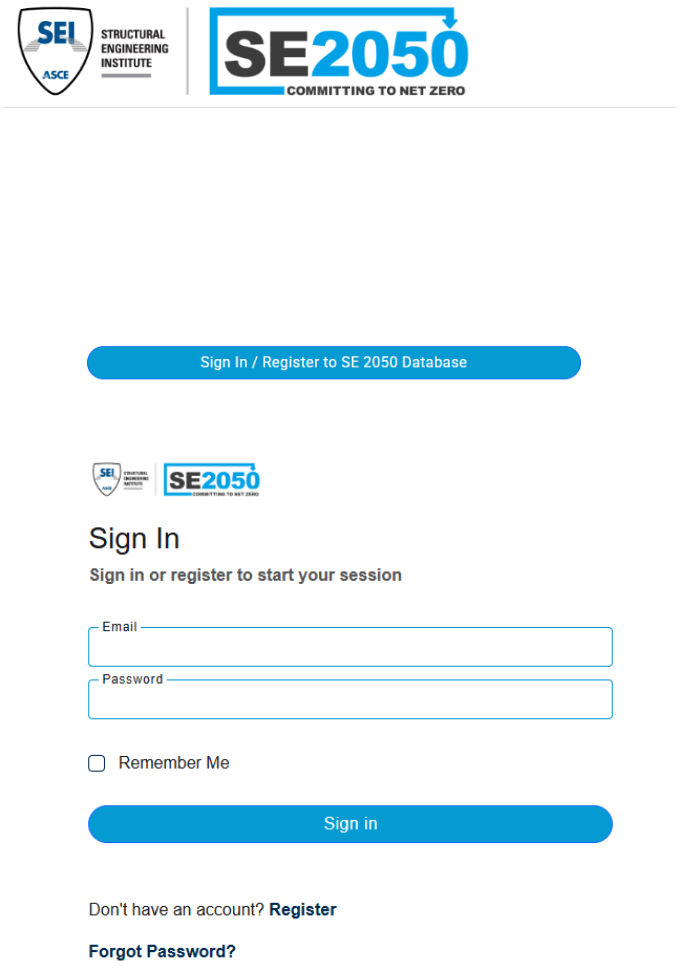
The User Guide has been written under the assumption that the project is located within the United States, and several database field descriptions are based on the most recent versions of International Building Code (IBC) and ASCE 7. While it is still encouraged that non-U.S. projects are added to the Database, this may require Users to determine appropriate equivalency to the Database entry fields.

This database would not exist without the participation and support of SE 2050 Signatory Firms. Your comments, questions, and suggestions are always welcome at database@se2050.org.

1.0 - Using the SE 2050 Database

1.1 - Accessing the Database

After a firm joins the SE 2050 Commitment Program, firm members may register for an SE 2050 Database user account here: https://database.se2050.org.



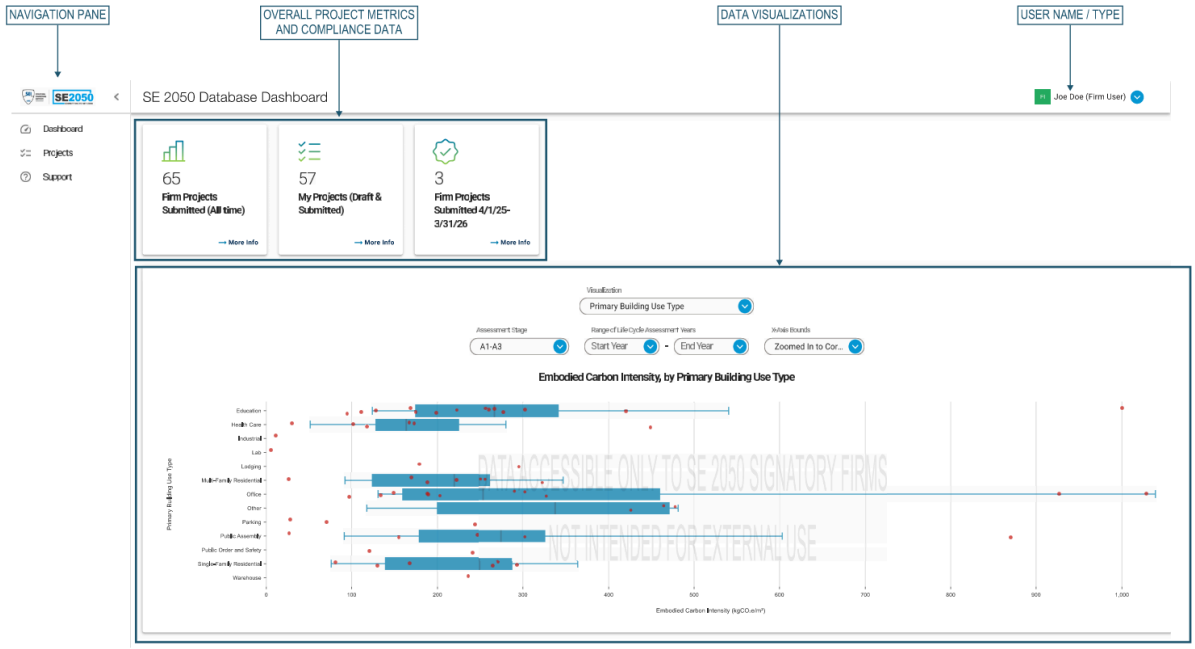
Upon registration, you will be assigned one of two user types:

User Type	Who	Privileges
Firm Admin	- The designated Embodied Carbon Champion for each firm is a Firm Admin by default	- Add new projects - View or edit data for any project submitted by the firm - Add new Firm Users - Upgrade a Firm User account to Firm Admin

	- Additional users as designated by an existing Firm Admin	- Toggle Firm Users between Active/Inactive. This may be used, for example, if a Firm User leaves the firm. Projects created by a Firm User that become inactive will still be associated with that Firm User, but the Inactive Firm User will not be able to access the SE 2050 Database. The Firm Admin can still edit or delete the Project.
Firm User	- Any user with a company email may request a Firm User account and must be approved by a Firm Admin	- Add new projects - View data for any project submitted by the user's firm - Edit data only for projects submitted by the user

1.2 - Dashboard

Once a registered account has been activated, Users may log in to the Database and access the SE 2050 Database Dashboard.



From the Dashboard, Users can see their User Type, how many projects they've added to the Database, how many projects their firm has added, compliance data for the current data submission year, and data visualizations summarizing metrics such as Embodied Carbon Intensity mapped against Primary Building Use Type, Number of Stories, Primary Lateral

System, etc. In addition, the data visualizations include breakdowns for Embodied Carbon Intensity by Element or Material and Concrete, Steel, or Timber Use Intensity by Element. .

Navigation Pane

The Navigation Pane includes the following options:

- **Dashboard**: returns User to the Dashboard from any module
- **Firm Admin** (Available for Firm Admin user type only): List of all all Firm Admins in the Firm, *including the current user*, with options to activate/deactivate Firm Admins, or downgrade a Firm Admin to a Firm User
- **Firm Users** (Available for Firm Admin user type only): List of all Firm Users, *excluding Firm Admins*, with options to add new Firm Users, activate/deactivate Firm Users, or upgrade a Firm User to Firm Admin
- **Projects**: See Projects
- **Support**: See Support.

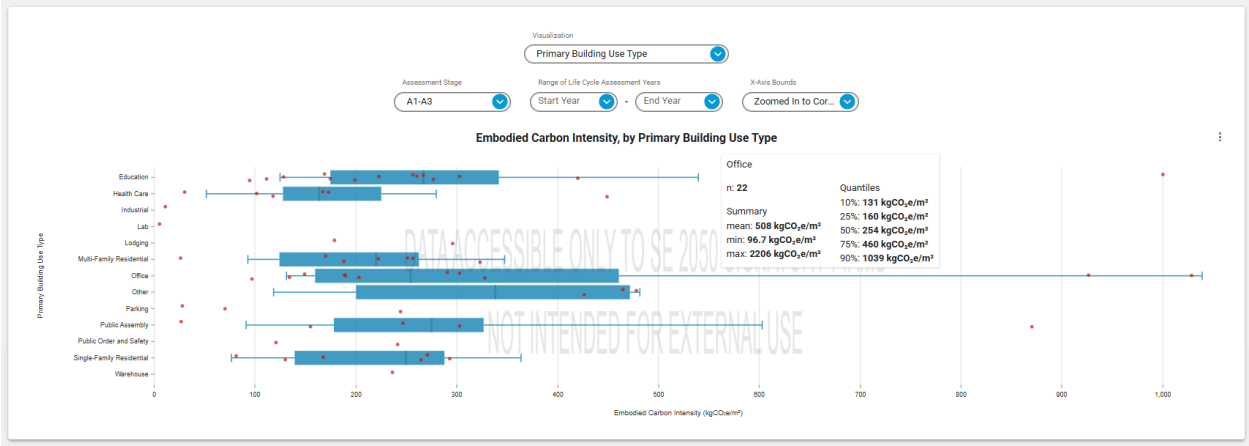
User Name / Type

The User Name / Type includes a dropdown with the following options:

- **Edit Profile**: User can edit their own name, email adress, and location.
- **Change Password**: User can request a password reset email to change their password.
- **Support:** Link to support menu (see Support).
- **Logout**

Data Visualizations

Several data visualizations are available for users to toggle through. The main categories of data visualizations include Distribution, Breakdown, Heatmap, and Performance Over Time. The Distribution, Breakdown, and Performance Over Time data visualizations show Embodied Carbon Intensity for buildings submitted by the User's firm (shown as individual data points) and all buildings submitted to the database (shown as box and whisker plots). The box and whisker plots for all data provide summary data for each parameter which includes number of projects, mean, min, max, and quantiles. Users can hover over each individual box and whisker plot to see this data.



In the **Distribution** section, users can sort data by the following fields:

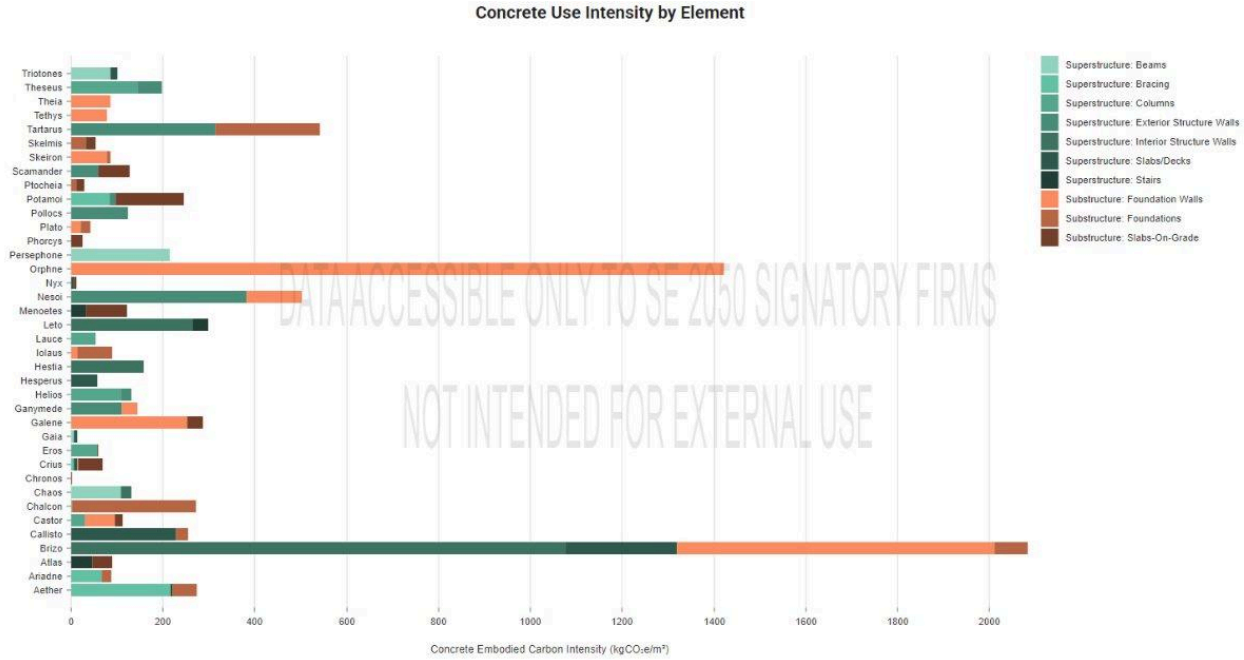
- Primary Building Use Type
- Primary Horizontal Gravity System
- Primary Lateral System
- Number of Stories Above Grade
- Gross Square Footage
- Concrete Use Intensity - All Projects
- Steel Use Intensity - All Projects
- Timber Use Intensity - All Projects

The **Distribution** data visualizations can be filtered by “Assessment Stage”, “Range of Life Cycle Assessment Years”, and “X-Axis Bounds”, which allows users to view data “Zoomed in to Core Distribution” or “Zoomed Out to Show Outliers”.

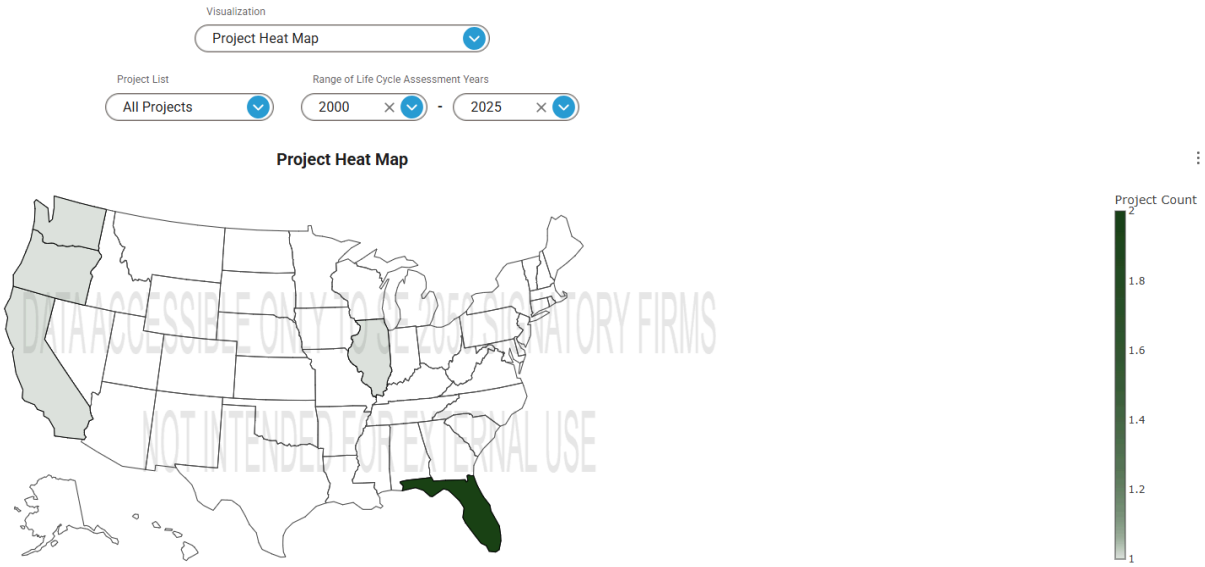
In the **Breakdown** section, users can sort data by the following options:

- Embodied Carbon Intensity by Element
- Embodied Carbon Intensity by Material
- Concrete Use Intensity by Element
- Steel Use Intensity by Element
- Timber Use Intensity by Element

The **Breakdown** data visualizations allow users to filter Embodied Carbon Intensity by Element and Embodied Carbon Intensity by Material based on the “Range of Life Cycle Assessment Years”. Users can filter Concrete, Steel, and Timber Use Intensity by Element based on the “Intensity Metric” (Use vs. Carbon) and “Range of Life Cycle Assessment Years”.



Users can also visualize a graphic showing project counts by U.S. state using the **Project Heat Map**. Lastly, users can visualize the Embodied Carbon Intensity of their projects by year using the **Performance Over Time** data visualization.

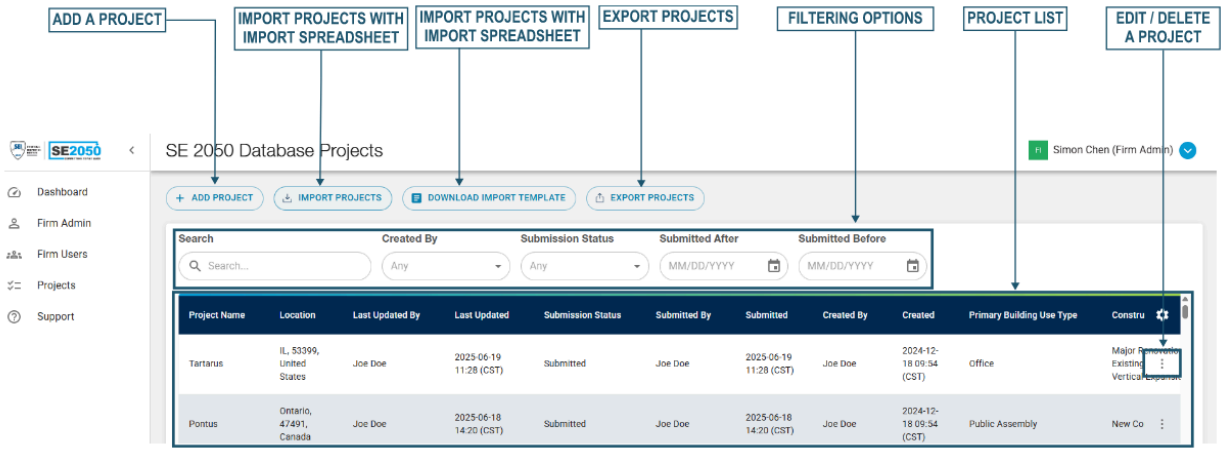


In all data visualizations, users can download all visualizations as a PNG or PDF file by selecting the ellipsis menu at the top right corner of the visualization.

Project data submitted by a User's firm is only visible to that firm and remain anonymous to other signatory firms. By using box and whisker plots to show the aggregated data within the whole database, data shown in the **Distribution** category provide an anonymized data visualization with only the User's firm data overlaid as data points. Furthermore, the **Breakdown** and **Performance Over Time** categories only shown project data submitted by a User's firm. Regardless of data visibility, the data entered into the database may be used in accordance with the SE 2050 Database User Agreement. Please refer to se2050.org/se-2050-database/ for more information regarding the individuals and organizations that have access to the data in the database.

1.3 - Projects

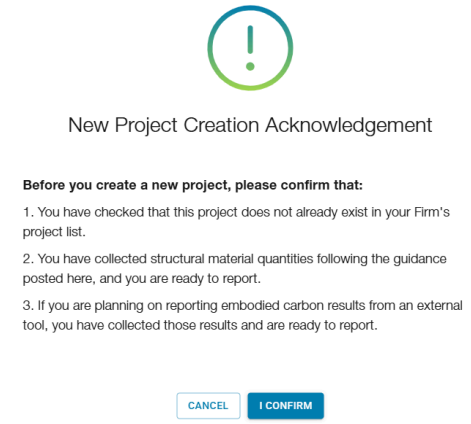
Navigate to the Projects page by clicking on “Projects” in the navigation pane. Here, Users can add a project, edit existing project data (subject to the limitations of the User Type), and view existing firm data.



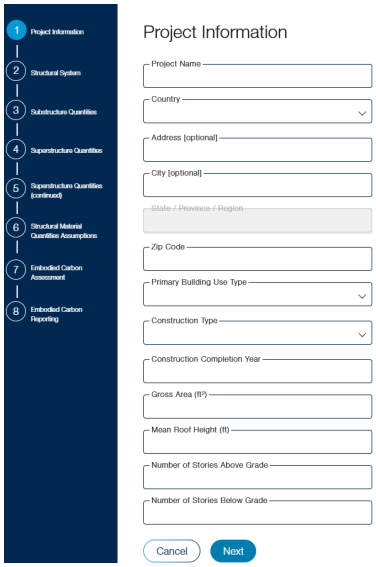
Add Project

Click this to open the New Project page and add a new project. Users will be prompted with a New Project Creation Acknowledgement to verify:

1. You have checked that this project does not already exist in your Firm’s project list.
2. You have collected structural material quantities following the guidance posted here, and are ready to report.
3. If you are planning on reporting embodied carbon results from an eternal tool, you have collected those results and are ready to report.



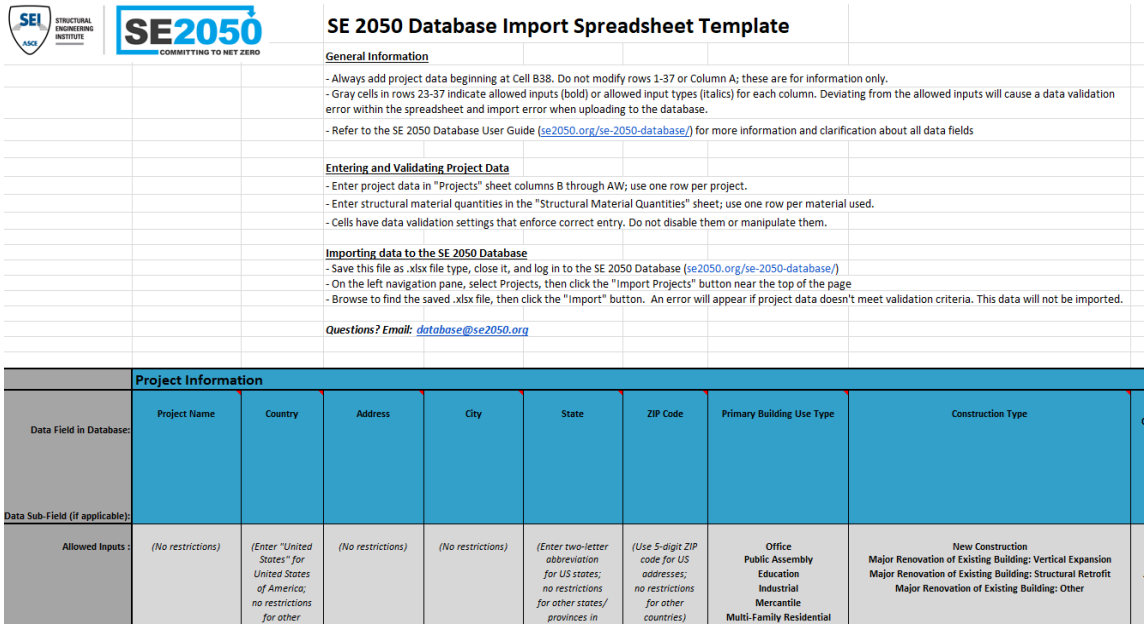
Users can then select “I CONFIRM” to proceed to the project input wizard, which requires users to step through filling out data fields for Project Information, Structural System, Substructure Quantities, Superstructure Quantities, Structural Material Quantities Assumptions, Embodied Carbon Assessment, and Embodied Carbon Reporting.



See User Guide sections 2.0 through 6.0 for detailed guidance about each input parameter.

Import Projects
Click this to open the Import Project module.

To import one or more projects using a spreadsheet (.xlsx), first download the sample import spreadsheet by clicking the button titled "DOWNLOAD IMPORT TEMPLATE". The spreadsheet contains detailed instructions for properly filling out the spreadsheet and importing projects using the .xlsx file. See Appendix D - Using the Project Import Spreadsheet for further information on using the spreadsheet.



SE 2050 Database Import Spreadsheet Template

General Information

- Always add project data beginning at Cell B38. Do not modify rows 1-37 or Column A; these are for information only.
- Gray cells in rows 23-37 indicate allowed inputs (bold) or allowed input types (italics) for each column. Deviating from the allowed inputs will cause a data validation error within the spreadsheet and import error when uploading to the database.
- Refer to the SE 2050 Database User Guide (se2050.org/se-2050-database/) for more information and clarification about all data fields

Entering and Validating Project Data

- Enter project data in "Projects" sheet columns B through AW; use one row per project.
- Enter structural material quantities in the "Structural Material Quantities" sheet; use one row per material used.
- Cells have data validation settings that enforce correct entry. Do not disable them or manipulate them.

Importing data to the SE 2050 Database

- Save this file as .xlsx file type, close it, and log in to the SE 2050 Database (se2050.org/se-2050-database/)
- On the left navigation pane, select Projects, then click the "Import Projects" button near the top of the page
- Browse to find the saved .xlsx file, then click the "Import" button. An error will appear if project data doesn't meet validation criteria. This data will not be imported.

Questions? Email: *database@se2050.org*

	Project Information								
Data Field in Database:	Project Name	Country	Address	City	State	ZIP Code	Primary Building Use Type	Construction Type	
Data Sub-Field (if applicable):									
Allowed Inputs :	*(No restrictions)*	*(Enter "United States" for United States of America; no restrictions for other*	*(No restrictions)*	*(No restrictions)*	*(Enter two-letter abbreviation for US states; no restrictions for other states/ provinces in*	*(Use 5-digit ZIP code for US addresses; no restrictions for other countries)*	**Office Public Assembly Education Industrial Mercantile Multi-Family Residential**	**New Construction Major Renovation of Existing Building: Vertical Expansion Major Renovation of Existing Building: Structural Retrofit Major Renovation of Existing Building: Other**	

All fields for a project must have an appropriate input value for the project to import successfully. The sample spreadsheet lists acceptable data types for each field, and in-cell data validation is used in most fields to limit potential import errors.

After an import is attempted, a message will appear at the top of the screen indicating either that all projects were imported successfully or that the project(s) failed to upload. If the project(s) failed to upload, this may be due to incorrect data inputs within the spreadsheet.

Please contact database@se2050.org for any questions or to report unexpected behavior.

Project List

This list shows a select set of important project parameters for a user's projects. There are two ways to view all parameters for a project:

- Edit Project by selecting the ⋮ button and selecting Edit
- Export Projects using the EXPORT PROJECTS button as described below.

Additional Project List features:

- Sort the Project List by clicking on the up/down arrows next to any column heading
- Filter the list by typing in the Search bar in the upper left corner of the Project List. This will search across all parameters shown on the list. To search or filter based on the project creator, submission status, and submission date, use the filters adjacent to the Sear bar. If users would like to filter by a specific parameter not shown in the Project List, we recommend exporting the full project list as an Excel spreadsheet and adding a filter to the header row of the spreadsheet.

Export Projects
This will export a complete list of project fields to an Excel (.xlsx) file for all of the projects that a user has access to (see 1.1 - Accessing the Database for more information about User permissions).

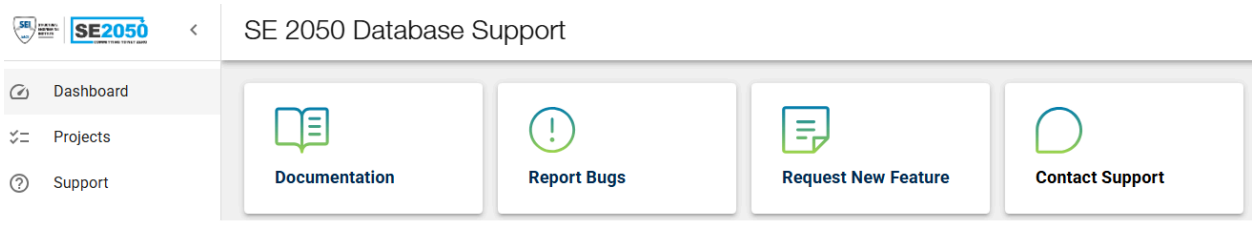
Edit Project
Project data may be edited at any time by any user that has the required permission (see 1.1 - Accessing the Database for more information about User permissions). To begin editing, click on the ⋮ button next to the project in the Project List and select Edit (Edit) from the options. This will take you to the Add Project page, but all input fields will be prefilled with the current project data. To make changes, edit any number of inputs, then click the Save & Exit (Save & Exit) button at the bottom of the page to apply changes to the project. To return to the Projects page without saving changes, click the Back (Back) button until you return to the Project Information page and then click the Cancel (Cancel) button.

Delete Project
A project may be deleted at any time by any User that has the required permission to edit the project (see 1.1 - Accessing the Database for more information about user permissions). To delete a project, click on the ⋮ button next to the project in the Project List and select Delete (Delete) from the options, then click "YES, DELETE THIS PROJECT" when prompted by the popup to confirm the deletion. Once a project is deleted, it cannot be recovered.

1.4 - Support

Includes links to key support features including the following:

- **Documentation**: includes a link to the User Guide.
- **Report Bugs**: allows users to send the SE 2050 Database a description of a bug they have identified in the database.
- **Request a New Feature**: allows users to submit a request for a new feature to be implemented in the database.
- **Contact Support**: provides a link to contact the SE 2050 database team through the database@se2050.org email address.



2.0 - Project Information

Project Information inputs collect project-specific data not directly related to the Embodied Carbon. The goal of collecting this data is to allow for the eventual development of industry-wide benchmarks and targets specific to relevant project parameters.

The following sections provide a description of each input related to Project Information with notes to the User as appropriate.

2.1 - Project Name

Enter the name of the project, using the official project name at completion if known.

The Project Name is only used for project identification among users in your firm. It is permissible to enter "confidential" in the Project Name field.

2.2 - Country

Select the country where the project is located from the dropdown.

2.3 - Address

Enter the project street address or closest known address in the text box.

The Address is only used for project identification among users in your firm. It is permissible to enter "confidential" in the Address field.

2.4 - City

Enter the name of the city where the project is located.

The City is only used for project identification among users in your firm. It is permissible to enter "confidential" in the City field.

2.5 - State / Province / Region

Select state, province, or region where the project is located from the dropdown.

2.6 - Zip Code

Use 5-digit ZIP code for US addresses.

The Zip Code is only used for project identification among users in your firm. It is permissible to enter “00000” in the Zip Code field if this information is sensitive.

If the project is not in the United States:
Enter the relevant postal code for the country the project is in, or enter “00000” if no postal code is used.

2.7 - Primary Building Use Type

Select one of the following options using the dropdown:

Primary Building Use Type
Input Options
Office
Public Assembly
Education
Industrial
Mercantile
Multi-Family Residential
Warehouse
Other
Public Order and Safety
Single-Family Residential
Parking
Lodging
Health Care
Lab
Data Center

For mixed-use buildings:
Select the use with the greatest floor area devoted to it.

What is the basis of this list of options?
Various building use classification systems were considered in creating the available list of options - primarily those used by the IBC and the Commercial Buildings Energy Consumption Survey (CBECS).

Appendix C - Primary Building Use Classification provides a comparison between these classification systems and includes references to further guidance if the proper classification is not clear.

2.8 - Construction Type

Select one of the following options using the dropdown:

Construction Type	
Input Options	*Description*
New Construction	- Brand new building on a greenfield or brownfield site - New building in the place of a demolished building if no existing elements are being reused - Horizontal expansion of an existing building in which there is very little structural interaction between the old and new buildings
Major Renovation of Existing Building: Vertical Expansion	- Vertical expansion of an existing building (new stories added on top of existing stories)
Major Renovation of Existing Building: Structural Retrofit	- Renovation that involves significant modifications to structural framing such that IEBC code is triggered (5% of mass, …)
Major Renovation of Existing Building: Other	- Retrofitting for seismic or other hazards

A pure horizontal expansion of an existing building is generally considered New Construction.

The database is not currently intended for the following types of projects:
- Tenant improvement (TI) projects which primarily include modification to non-structural elements
- Infrastructure projects that are not similar to buildings
    - For example, a train station is an appropriate project type for the database, whereas a concrete gravity dam or highway should be excluded.
    - Future development to the Database is planned to incorporate infrastructure projects.

2.9 - Construction Completion Year

Enter the year when the contractor has completed or anticipates completing all work specified in the construction contract in accordance with the construction documents (specifications and drawings). All punch list work and final inspections have been completed (or are anticipated to be complete) at this time.

2.10 - Gross Area (ft^2)

Gross Area (or gross square footage) of a building shall represent the total horizontal area, measured in plan, taken to the outer edge of the exterior envelope. The area value reported shall be consistent with the architectural information of the project and follow a standard calculation method, such as those published by the Building Owners and Managers Association International (BOMA) for various building types. It is not recommended for structural engineers to calculate this value separately.

For renovation projects:
The gross area shall represent the total area of the existing building being renovated/retrofitted and any new area added.

2.11 - Mean Roof Height (ft)

Mean Roof Height shall match the quantity “h” per ASCE 7 wind loading provisions, measured from the base to the roof of the structure. For sloped roof structures, the average elevation of the roof shall be used to calculate “h”. Parapets or other roof appendages shall not be included in the Mean Roof Height.

For renovation projects:
The Mean Roof Height shall be that of the total completed building, including the existing structure and any additions.

2.12 - Number of Stories Above Grade

Enter any non-negative Number of Stories Above Grade following ASCE 7, which defines a story above the grade plane as one in which “the floor or roof surface at the top of the story is more than 6 ft above grade plane or is more than 12 ft above the finished ground level at any point on the perimeter of the structure.” Small mezzanine areas that have floor areas of less than 10% of that of an adjacent floor shall not be counted in the total number of stories.

For renovation projects:
The Number of Stories Above Grade shall be that of the total completed building, including the existing structure and any additions.

2.13 - Number of Stories Below Grade

See 2.13 for definition of stories above grade. Stories below grade shall be any stories below those considered above grade.

3.0 - Structural System Information

3.1 - Typical Column Grid, Long Direction (ft)

Enter the center-to-center spacing of the project's typical column grid in the long direction. It is acknowledged that projects will have columns at some non-typical spacing. Engineers shall use judgment to establish what column grid represents a majority of the horizontal framing area of the building. The purpose of collecting this information is to understand how embodied carbon is related to span lengths due to changes in beam framing material quantities, so the users shall select a span value that is representative of the predominant framing configuration for their project. An average span may be used if the building has a very irregular column layout with no "typical" bays.

For light-frame floors (typically wood or cold-formed steel joists) supported by continuous walls: Enter the typical joist span.

3.2 - Risk Category

Select the Risk Category as defined by ASCE 7.

3.3 - Typical Floor Live Load (psf)

Enter the typical design live load pressure in the occupied areas of the building in units of pounds per square foot (psf). As the building will have a variety of live load requirements, this value should represent the loading value that covers the majority of the building framing. Note that this floor live load shall represent the actual design load of the project, which may be greater than the code minimum live load values specified in ASCE 7 due to building-specific requirements.

3.4 - Ground Snow Load (psf)

Ground snow load shall match the value of p_g as defined by ASCE 7. The reported value shall represent the actual value used for the project, which may be greater than minimum values in ASCE 7, based on specific requirements for the project or as required by the AHJ. For projects in which snow loads were not considered, a value of 0 shall be entered.

3.5 - Ultimate Wind Speed (mph)

Wind speed defined as V per ASCE 7. The reported value shall represent the actual value used for the project, which may be greater than minimum values in ASCE 7, based on specific requirements for the project as required by the AHJ.

3.6 - Seismic Design Category

Classification based on risk category and design earthquake level of the site per ASCE 7

3.7 - Primary Horizontal Gravity System

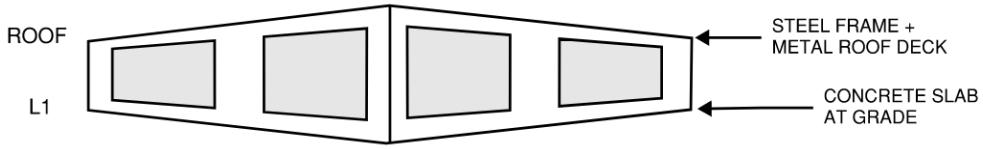
Select the option that best represents the building's primary horizontal gravity framing system based on the following system descriptions:

Primary Horizontal Gravity System	
Input Options	*Description*
Concrete: PT Framing	Concrete framing with PT tendons and mild reinforcing bars. Includes 2-way slab and1-way with beams.
Concrete: Non-PT Framing	Cast-in-place concrete system with only mild reinforcing. Includes 2-way slab and 1-way with beams.
Concrete: Precast	System of precast elements. System may be prestressed and may include a concrete topping.
Concrete: Other	2/3 of the floor area is composed of a concrete framing system not listed above or a combination of different concrete framing systems.
Steel: Frame + Concrete on Metal Deck	Concrete or Composite slab on metal deck with steel supports, such as wide-flange beams or open web steel joists (OWSJ).
Steel: Frame + Bare Metal Deck	Steel framing members with bare metal deck. This system should be selected when a majority of the horizontal framing in the structure is metal roof deck.
Steel: Other	2/3 of the floor area is composed of a steel framing system not listed above or a combination of different steel framing systems.
Wood: Joists and Sheathing	Plywood or OSB decking supported by wood joists. Joists may be standard wood or engineered wood.
Wood: Engineered Panels	CLT, DLT, NLT, GLT or other engineered wood panels. May include concrete topping.
Wood: Other	2/3 of the floor area is composed of a wood framing system not listed above or a combination of different wood framing systems.
Other Material (not concrete, steel, or wood)	2/3 of the floor area is composed of a framing system not listed above.

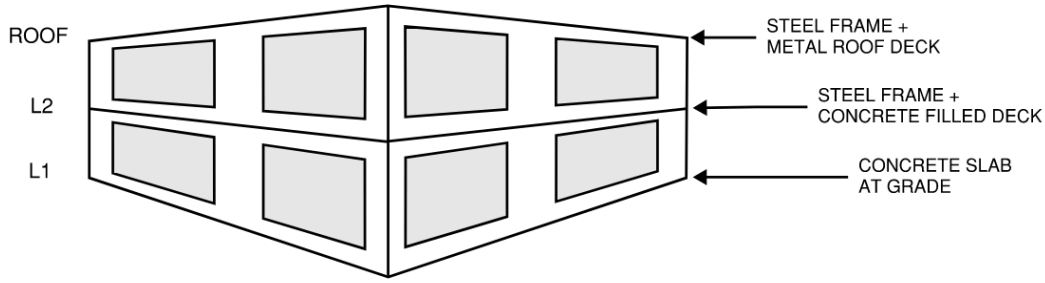
For the SE 2050 database, the Primary Horizontal Gravity System is defined as the system comprising at least ⅔ of the combined floor and roof area of the superstructure (excluding the

slab at grade). The slab at grade is considered part of the substructure, regardless of whether the slab bears on soil or is designed as a suspended slab. See guidance examples below:

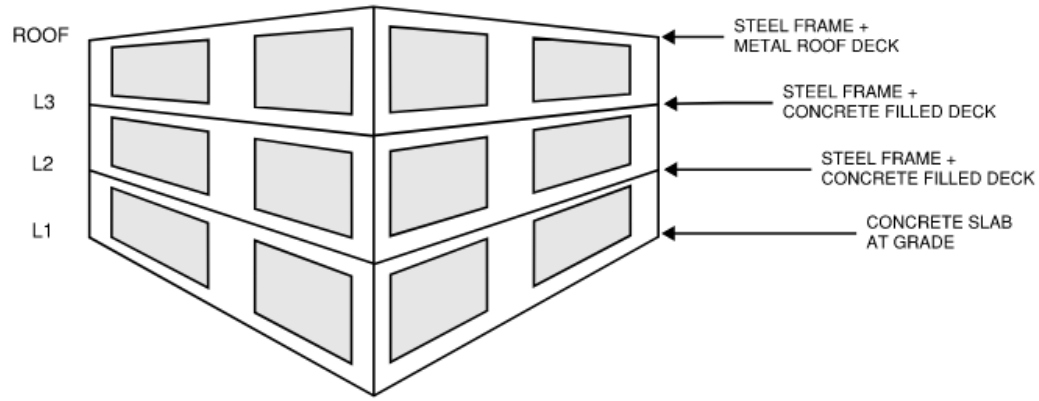
For a one story building with a concrete slab at grade and a steel frame with bare metal deck roof:
Select “Steel: Frame + Bare Metal Deck Roof” regardless of the type of slab at grade.



For a two-story building with a concrete slab at grade, steel frame with concrete filled metal deck floor at Level 2, and steel frame with metal deck roof:
Select “Steel: Other” because approximately 50% of the combined elevated floor and roof area is concrete filled metal deck and 50% is bare metal deck.



For a three-story building with a concrete slab at grade, steel frame with concrete filled metal deck floor at Levels 2 and 3, and steel frame with metal deck roof:
Select “Steel: Frame + Concrete on Metal Deck” because approximately ⅔ of the combined elevated floor and roof area is concrete filled metal deck, and this meets the ⅔ threshold.



For a structure that includes multiple materials, with no system making up more than ⅔ of the superstructure floor area:
Select the “Other” category associated with the material that makes up the most superstructure floor area.

3.8 - Primary Vertical Gravity System

Select the option that best represents the building’s primary vertical gravity framing system based on the following system descriptions:

Primary Vertical Gravity System	
Input Options	*Description*
Concrete: CIP	Cast-in-place concrete columns and walls
Concrete: Precast	Precast concrete columns and walls
Concrete: Other	Other Concrete Vertical Gravity System
Steel: Columns	Steel wide flange or rectangular, square, or round hollow structural section columns
Steel: Cold-Formed	Cold-formed steel columns and/or Light-frame cold-formed steel bearing walls
Steel: Other	Other Steel Vertical Gravity System
Wood: Mass Timber	Mass or heavy timber columns, e.g. Glulam
Wood: Light-Frame	Light-Frame wood bearing walls
Wood: Other	Other Wood Vertical Gravity System
Masonry	Masonry columns and/or bearing walls
Other Material (not concrete, steel, or wood)	Other material not listed above

For mixed vertical systems, the guidelines for selection of the horizontal system also apply.

3.9 - Primary Lateral System

Select the option that best represents the building's primary lateral framing system based on the following system descriptions:

Primary Lateral System	
Input Options	*Description*
Concrete: Shear Walls	CIP or Precast Shear Walls
Concrete: Moment Frames	CIP or Precast Concrete Moment Frames
Concrete: Other	Other, including concrete cantilevered columns, or multiple steel systems including all-steel dual systems
Steel: Braced Frames	Steel braced frame, including buckling restrained braces (BRB)
Steel: Moment Frames	Steel moment frames
Steel: Other	Other, including steel plate shear walls, steel cantilevered columns, or multiple steel systems including all-steel dual systems
Light Frame Shear Panels	Wood or cold formed walls with shear panels such as plywood or OSB
Masonry: Shear Walls	Masonry Shear Walls
Wood: Shear Panels	Engineered wood shear panels, including CLT
Wood: Other	Other, including wood cantilevered columns or light-framed walls with shear panels of non-wood materials
Other	Material not listed above, or no single material predominates (includes Dual Systems with multiple materials)

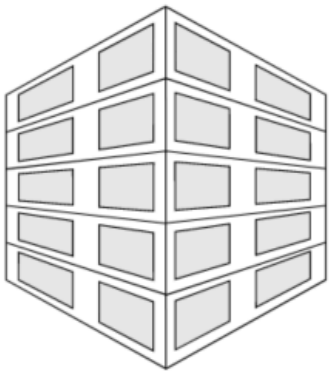
For mixed lateral systems, the guidelines for selection of the horizontal system also apply.

3.10 - Podium

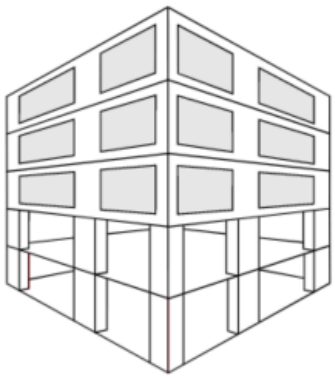
Select one of the following options using the dropdown:

Podium	
Input Options	*Description*
Not a Podium Building	Select this if the building does not have a podium (see definition below).
Primary System Defined Above is On a Podium	Select this when the majority of floors in the *superstructure* (excluding slab at grade - see Section 4.4) are above the podium.
Primary System Defined Above is a Podium	Select this when the majority of floors in the *superstructure* (excluding slab at grade - see Section 4.4) are a part of the podium.

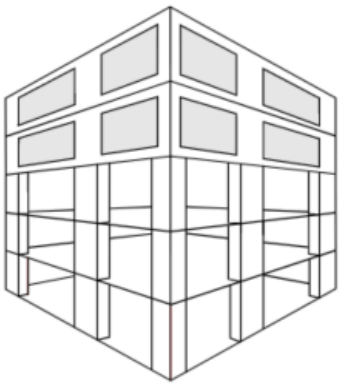
A podium building is one that is split vertically into two distinct zones with different structural systems and/or materials. One common example of this type of building is a residential structure comprising several stories of light wood framing over one or two levels of concrete framing.



Not a Podium Building



Primary System Defined Above is On a Podium



Primary System Defined Above is a Podium

Although it would be interesting and potentially beneficial for benchmarking purposes for the user to enter separate building information and Embodied Carbon data for each system in a podium building, the SE 2050 Database does not have this feature currently. Furthermore, it may be more onerous on the user in many cases to split up the Embodied Carbon attributed to the podium portion versus non-podium portions of the building.

Therefore, at this time, the user should select as the “primary” structural system whichever system is used for the majority of superstructure floors. By including this question in the SE

2050 Database, it will be possible to distinguish buildings that are generally one system (per the rules established in Section 2.23) from those that have multiple distinct systems.

If the number of podium and non-podium superstructure floors are equal:
Select the non-podium system as the “primary” system.

Should I enter the Embodied Carbon for only the “primary” structural system?
No - always enter the Embodied Carbon for the entire building structure, regardless of the structural system defined as “primary.” This is because the podium design is still affected by the structure above and the foundation carries the load of both the podium and non-podium. Entering a fictitious structure with inherent incongruencies is likely to be more misleading than entering complete building information with identifiers for it to be easily set apart in future data analysis.

3.11 - Foundation Type

Select the building’s primary foundation type from one of the following options using the dropdown:

Foundation Type	
Input Options	*Description*
Shallow Foundations	Spread footings, strip foundations, mat foundations, or raft foundations
Deep Foundation < 50ft/15m	Foundation systems with overall depth (e.g. piles) < 50 feet or 15m
Deep Foundation > 50ft/15m	Foundation systems with overall depth (e.g. piles) > 50 feet or 15m
Other Foundation System	Other foundations

3.12 - Allowable Soil Bearing Pressure (psf)

Enter the allowable soil bearing pressure in pounds per square foot (psf), selecting from one of the following:

Allowable Soil Bearing Pressure (psf)
Input Options
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
15,000
20,000
30,000
40,000

The Allowable Soil Bearing Pressure represents the load the soil is capable of supporting without failure and without intolerable settlement of the structure and should be consistent with the value used for the design of foundations, whether from a site-specific geotechnical report or presumptive values found in the IBC.

If your project's allowable bearing pressure does not appear on this list:
Choose the value closest to your bearing pressure; round up as a tiebreaker

If your project has multiple bearing pressures at different locations on the site:
Use your judgment to input an approximate "weighted average" site bearing pressure based on the total weight supported at each .

Example:
⅔ of total building weight bears on shallow foundations with 6,000 psf allowable
⅓ of total building weight bears on shallow foundations with 8,000 psf allowable
Average: 0.67*6000+0.33*8000 = 6,660 → Input **7,000 psf**

If your building is supported primarily on deep foundations:
Enter the allowable soil bearing pressure for shallow footings on the site, if known. Enter 2000 if unknown. Do not include the allowable bearing pressure or side friction for deep foundations.

4.0 - Structural Material Quantities Reporting

This portion of the database was newly added when creating the new database from the beta database. In creating the new database, the SE 2050 committee decided to make a major shift in data collection from embodied carbon results to Structural Material Quantities (SMQ), which offers three primary benefits:

1. It frees the users from needing to learn one of the tools accepted by the database.
2. It enables users to see material use results, with the intent of encouraging more material efficient designs.
3. It provides a more like-to-like comparison of A1-A3 results on the dashboard, based on default embodied carbon factors in ECOM, which will be important for as long as embodied carbon factors for structural materials remain different across third party tools.[1]

Results from LCA and embodied carbon tools can still be entered in the Embodied Carbon Reporting portion of user input (see Section 6.0), but the new SMQ collection means the database will now auto-calculate A1-A3 embodied carbon for users based on the material quantities entered. The calculated results will automatically appear in other summary pages as project results, unless the user chooses to override them.

4.1 - Overall Structure of Structural Material Quantities Collection

The new database collects material quantity data in nine categories; 3 categories under “Substructure” and 6 categories under “Superstructure” grouped over three pages numbered as “3”, “4”, and “5” on the navigation bar.

Substructure	**Superstructure**	**Superstructure**
Foundation	Slabs/Decks	Bracing
Foundation Walls	Beams	Stairs
Slab on grade	Columns	Exterior Structural Walls
		Interior Structural Walls

[1] This is also important for the SE 2050 goal of setting benchmarks. The inconsistency in embodied carbon factors across tools was a significant source of “noise” in the project embodied carbon results of the beta database, adding to the difficulty of setting benchmarks. See the SE 2050 Embodied Carbon Intensity Diagram for more detail about the differences in structural embodied carbon results stemming from the use of different tools.

Each of the nine categories of the SMQ data collection has at least one row of inputs that requires identification of the *material, material type*, and corresponding *quantity*. Users may add as many rows as needed to capture all the materials they choose to report within the assembly. An example for the *Foundations* category is shown below. If the assembly does not exist for the building structure of the project at hand, users can leave the quantity field blank.

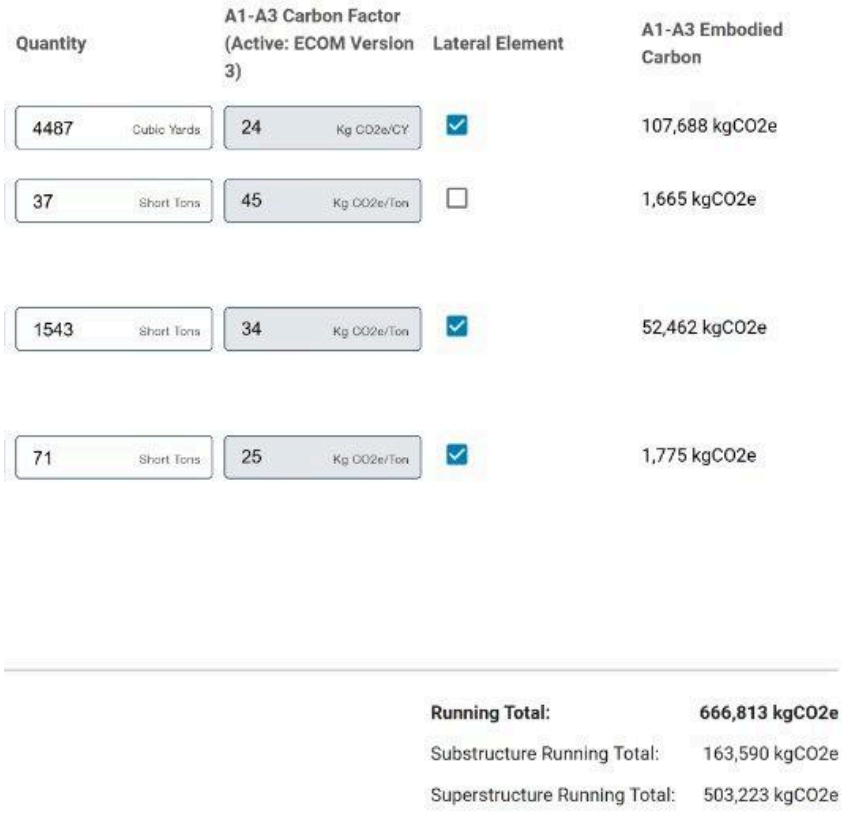
4.2 - Units for Structural Material Quantities Collection

Units for all material type options are shown below. There is currently no option to change the unit system, so if any conversions are necessary, users will need to perform them before entering the quantity values.

Material Category	Material Type	Units
Concrete	2500 PSI; 3000 PSI; 4000 PSI; 5000 PSI; 6000 PSI; 8000 PSI; 3000 PSI LW; 4000 PSI LW; 5000 PSI LW	cyd
Steel Reinforcement	Rebar; Welded Wire Reinforcement; Post Tensioning	tons
Masonry	Normal Weight Masonry Block	tons
Masonry	Light Weight Masonry Block	tons
Masonry	Masonry Grout	cyd
Masonry	Mortar	cyd
Steel	Rolled Steel Shapes; Plate Steel Fabrications; Tube Steel (HSS); Open Web Steel Joists; Steel Deck; Cold Formed Metal Framing	tons
Timber	Softwood Lumber; Softwood Plywood; Glue Laminated Timber; Cross Laminated Timber; Laminated Veneer Lumber	cft
Timber	Wood I Joists	lbs

Once the material information has been entered, the *A1-A3 Embodied Carbon* associated with the material quantity of the row will be displayed at the end of the row. The calculation uses the *A1-A3 Carbon Factor* displayed next to the *Quantity* values. These values are taken from the ECOM tool on the [se2050.org](se2050.org) website which is based on industry-wide EPDs. The tool version is noted and an embedded hyperlink can take users to the site. If the user wants to use different carbon factors, the default values may be overwritten in the grey cells, and the calculated values will use the user input instead. Running totals for the project, substructure, and superstructure are displayed at the bottom right.

The user can also check the *Lateral Element* box to identify whether the material entered for that row is part of the primary lateral force resisting system. This requires that material take-offs keep the gravity and lateral system separate before entering values into the database.



4.3 - Assembly Inclusions/Exclusions for SMQ Collection

The assemblies to include under these categories are defined in the last column of the table below. The list is aligned with the recently developed SE 2050 SMQ Taxonomy, which is the origin of the codes listed in the middle column. Level 5 refers to the assembly level, which is the 5th level of the 7-level taxonomy that links the higher-level substructure and superstructure to materials at level 7. For more information about the SE 2050 SMQ Taxonomy, see the draft white paper located on the se2050.org website.

SE 2050 Database	**SE 2050 Taxonomy**	
Substructure	**Level 5 Codes**	**Assemblies included**
Foundation	01 10 10 10 01 01 10 10 20 01 01 10 20 10 01 01 10 20 15 01 01 10 20 20 01 01 10 20 30 01 01 10 20 40 01 01 10 20 50 01 01 10 20 60 01 01 10 20 70 01 01 10 20 80 01 01 20 10 10 01 02	Foundation – Walls[1] and Footings Foundation – Columns[1] and Footings Driven Pile Bored / Drilled Pile Caissons Special Foundation Walls Foundation Anchors Underpinning Raft / Mat Foundations Pile Cap Grade Beam Subgrade Enclosure Foundation Wall Footing (retaining)[2]
Foundation Walls	01 20 10 10 01 01	Subgrade Enclosure Foundation Wall (retaining)[2]
Slabs-on-grade	01 40 10 01 01 01 40 20 01 01	Standard Slab-on-Grade Structural Slab-on-Grade
Superstructure	**Level 5 Codes**	**Assemblies included**
Slabs/Decks	02 10 10 20 01 02 10 20 20 01	Floor Decks, Slabs, and Toppings Roof Decks, Slabs, and Toppings
Beams	02 10 10 10 02 02 10 20 10 02	Beam Beams Supporting Roof
Columns	02 10 10 10 01 02 10 20 10 01	Column Columns Supporting Roof
Bracing	02 10 10 10 03 02 10 20 10 03	Bracing Roof diagonal bracing
Stairs	02 10 80 10 01	Stairs
Exterior Structural Walls	02 20 10 20 01 02 20 10 20 02	Exterior Walls Exterior Walls Supporting Roof
Interior Structural Walls	02 10 10 10 04 02 10 20 10 04	Interior Walls Interior Walls Supporting Roof
At Engineer's Discretion	*02 10 10 10 04* *02 10 20 10 04*	*Supplemental Floor Structural Frame* *Supplemental Roof Structural Frame*

In general, assembly organization and codes within Substructure follow OmniClass Table 21 while those in Superstructure were created for SE 2050 because OmniClass Table 21 does not provide sufficient granularity for the aims of structural material quantity collection.

As it is unrealistic to quantify absolutely all materials within structural assemblies, guidance on which components to include within different assemblies is provided in Appendix F (or Appendix B of the SE 2050 SMQ Taxonomy white paper). This guidance is also meant to establish consistency among projects in what is included or excluded and which components to report in which assemblies. An example of the guidance for the *Foundation Walls and Footings* assembly is shown below. Each table includes a list of the types of components that may comprise the assembly, listed as Primary, Accessory, Ancillary, and Excluded components. These terms come from the SEI Prestandard, which notes that inclusion of Primary components is required; Accessory and Ancillary components are optional, and Excluded components should not be included within structural embodied carbon assessments.

Level 5	**01 10 10 10 01 Foundation Walls and Footings (non-retaining)**		
Level 6	**Components**		
Primary	**01 10 10 10 01 01 Foundation Wall (non-retaining)** **01 10 10 10 01 02 Foundation Wall Footing (non-retaining)** **01 10 10 10 01 03 Foundation Walls and Footings - Other**		
Definition	A non-retaining foundation wall is typically constructed of reinforced concrete and cast-in-place on site using temporary formwork. It supports vertical loads, such as façade or perimeter wall loads, and is not designed to resist lateral soil pressure, as soil exists on both sides of the wall. These walls are commonly topped with a slab-on-grade. In colder climates, they are often referred to as “frost walls” due to their role in extending below the frost line. The wall typically bears on a spread footing, which is also constructed of reinforced concrete and is generally a few feet wide, running concentric with the base of the wall. This footing distributes the vertical loads from the wall to the underlying soil.		
Non-primary	**Accessory**	**Ancillary**	**Excluded**
Examples	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Masonry mortar; Stone mortar; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
Level 7	**Material / Product (MasterFormat)**		
	Div 03: Concrete Div 04: Stone, Masonry Block and Grout		

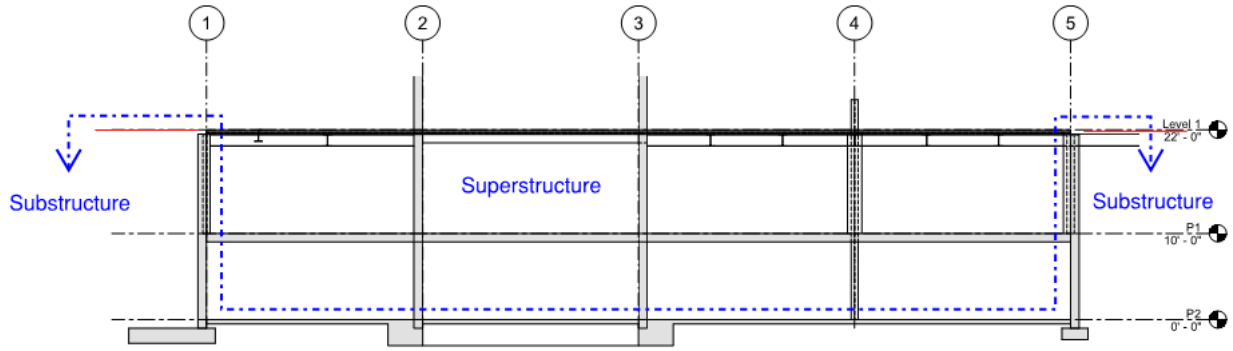
	Div 05: Steel Reinforcement and Tendons

These examples are provided to show classification scope and usage context for illustrative purposes and should not be seen as exhaustive lists. If a structural component is not listed in the reference tables, then inclusion or exclusion is at the user's discretion but should follow the principles of the SEI Prestandard.

The SMQ Taxonomy was produced in order to collect material quantities according to the assemblies they serve. Organizing material quantities according to the taxonomy allows the database to display project results broken down by assemblies. This allows users to examine which parts of their structural design are the highest source of embodied carbon and target improvements to these areas for improvement. It also helps users rationalize their input and detect any errors.

4.3.1 - Substructure Assemblies

See figure below for delineation of substructure and superstructure components. A key principle to this demarcation was to avoid splitting continuous vertical elements – such as columns or walls – across categories. Rather than using finish grade as the dividing line, the substructure is defined as the "bathtub" formed by perimeter foundation walls (whether or not they retain soil) and the lowest level slab – whether slab-on-grade or a framed slab that interfaces with the underlying soil. Any vertical structural element inside this perimeter and extending upward from the lowest level slab is considered part of the superstructure.



Some exceptions will require engineering judgment. For example, a column that penetrates modestly below a slab-on-grade for anchorage or detailing would still be classified as superstructure. These practical nuances are anticipated, and users are encouraged to interpret the taxonomy in alignment with its underlying intent, as shown in the figure above. Note that the red line indicates finished grade.

As listed in SE 2050 Taxonomy table in Section 4.3 above, the Substructure category includes the following:

Substructure	Assemblies Included
Foundation	Foundation – Walls[1] and Footings Foundation – Columns[1] and Footings Driven Pile Bored / Drilled Pile Caissons Special Foundation Walls Foundation Anchors Underpinning Raft / Mat Foundations Pile Cap Grade Beam Subgrade Enclosure Foundation Wall Footing (retaining)[2]
Foundation Walls	Subgrade Enclosure Foundation Wall (retaining)[2]
Slabs-on-grade	Standard Slab-on-Grade Structural Slab-on-Grade

[1] - "Walls" and "Columns" associated with the *Foundation – Walls and Footings* and *Foundation – Columns and Footings* assemblies, respectively, refer to relatively short walls (e.g. frost walls and cripple walls) and columns (e.g. pilaster and piers) under the slab-on-grade. Refer to figures in taxonomy white paper for further explanation. Full height walls and columns would normally belong with *Subgrade Enclosure Foundation Walls* while longer subgrade columns would more likely belong in the pile and caisson assemblies.

[2] - Level 6 components *Retaining Wall* and *Retaining Wall Footings* have been split into different categories for the SE 2050 Database because most engineers consider the footings below retaining walls part of the foundation rather than part of the foundation walls. Foundation walls were created as a separate category from foundation for the walls of subgrade enclosures, typically basement walls, because they are often constructed after completion of the foundation. In many cases, the concrete mixture for the basement wall is different from the footing below the wall. In contrast, much shorter walls and columns such as frost walls, pilasters, and piers below the slab on grade are often considered part of the foundation and are more likely to use the same concrete mixture as other assemblies within the foundation system. Refer to figures in taxonomy white paper for further explanation.

4.3.2 - Superstructure Assemblies

As listed in SE 2050 Taxonomy table in Section 4.3 above, the Superstructure category includes the following:

Superstructure	**Assemblies Included**
Slabs/Decks	Floor Decks, Slabs, and Toppings Roof Decks, Slabs, and Toppings
Beams	Beam Beams Supporting Roof
Columns	Column Columns Supporting Roof
Bracing	Bracing Roof diagonal bracing
Stairs	Stairs
Exterior Structural Walls	Exterior Walls Exterior Walls Supporting Roof
Interior Structural Walls[1]	Interior Walls Interior Walls Supporting Roof
At Engineer's Discretion[2]	*Supplemental Floor Structural Frame* *Supplemental Roof Structural Frame*

[1] - Interior Structural Walls have been kept separate from Exterior Structural Walls because of the separation of Interior from Exterior in OmniClass Table 21. If it is too onerous to quantify the materials for interior and exterior walls separately, it is acceptable for users to make their best estimate of the proportion of total wall material that is in each and enter materials based on applying that ratio to the material quantities for all superstructure walls.

[2] - The Supplemental Floor and Roof Structural Frames are not included in a specific Database category because they fall into the definition of Ancillary components according to the SEI Prestandard. The inclusion of these is optional and categorization for SMQ input is left to the engineer's discretion.

5.0 - Structural Material Quantities Assumptions

After the user has entered the required project information in accordance with Sections 2.0 through 4.0 above, the user has the option to enter Structural Material Quantities Assumptions corresponding to the project. The input of Structural Material Quantities will help tracking embodied carbon impacts of structural building systems as well as comparing material efficiencies.

5.1 - Data Source Used for Structural Material Quantities

The menu in the database includes four options for indicating how SMQs are estimated.

1. *Manual Approximation* methods include calculations of structural material quantities that engineers perform via spreadsheet or other means independent of commercially developed construction estimating tools.

2. *Quantity Takeoff from BIM* uses the estimating features within a digital building information model to report structural material quantities. BIM models may include various levels of detail. In many projects, steel connections and rebar are not fully developed in the BIM model for quantity estimation purposes. Rebar, for example, might be estimated as a steel percentage of concrete quantities. Even if manual calculations are required to complement BIM estimates, select *Quantity Takeoff from BIM* as the primary method for determining SMQs.

3. *Quantity Takeoff from other Design Documentation* refers to construction estimation that was conducted using scaled drawings or schedules of the structural components shown in the plan set and specifications. This category includes commercially developed construction estimation tools that have been developed to measure or calculate areas, lengths, counts of components, and volumes from scaled, 2D plans of the design in PDF format.

4. *Contractor Bill of Materials* may be the basis of the SMQ estimates. Each set of fabrication drawings typically includes a bill of materials that may be summed to estimate total structural material quantities, or SMQs may be taken from a comprehensive bill of materials provided by the contractor.

The data input in the following allowances fields Sections 5.2 through 5.4 does not alter previous SMQ inputs. Rather, the allowances fields are intended for SE 2050 to gather data on the assumptions made to account for quantities that are often estimated by percentages instead of meticulous measurements and tabulation.

5.2 - Steel Connection Allowances (Optional)

The *Steel connection allowances* input provides the option to enter an estimated percentage of steel weight used to account for the quantities of steel connections. If no assumption of steel connection quantities was made (i.e. the SMQs include only the steel weights of framing, bracing, and decking components), this input may be left blank. If actual weights of steel connections were included in the SMQs, users should leave the field blank or enter 0.

5.3 - Rebar Allowances (Optional)

The *Rebar allowances* input provides the option to enter an estimated percentage of rebar weight used to account for rebar laps, hooks, and splices. If no assumption of additional rebar quantities was made for laps, hooks, and splices were made, this input may be left blank. If actual weights of laps, hooks, and splices are included in the rebar SMQs, users should leave the field blank or enter 0.

5.4 - Concrete Waste Allowances (Optional)

The *Concrete waste allowances* input provides the option to enter an estimated percentage of concrete volume that was mixed during construction but ultimately not cast into the final structure. If no assumption of concrete waste was made (i.e. the SMQs include only the concrete volumes of the final structure), this input may be left blank. If an actual volume of concrete waste was included in the SMQ, users should leave the field blank or enter 0.

5.5 - A1-A3 Overrides (Optional)

If you entered custom A1-A3 carbon factors rather than using the default values for your structural material quantities inputs, please describe the data source you used to estimate these factors. The drop-down menu in the database includes the options listed below. If “Other” is selected, an input box appears for the user to specify the other data source used to determine other carbon factors.

Carbon Factor Data Source
Region-Specific EPD
Region-Specific Benchmark
EPD of Acceptable Proxy Materials
Product-Specific EPD
Other

5.6 - Additional Information (Optional)

If you made other critical assumptions to develop structural materials quantities in order to perform your embodied carbon assessment, you have the option to describe those assumptions here. Because notes that you input here might be reported to others outside your firm, please avoid including any personal or firm identifying information (including Firm name) in this input box.

6.0 - Embodied Carbon Assessment and Reporting

Global Warming Potential (GWP) Input Parameters collect project-specific GWP, or embodied carbon, data. The goal of collecting this data is to promote transparency among structural engineers throughout the industry. When combined with Project Input Parameters, the GWP Input Parameters will allow future analysis and trend-spotting within the Database.

The following sections provide a description of each GWP Input Parameter with notes to the User as appropriate.

6.1 - Third Party Embodied Carbon Assessment Tool

This field only appears if the box is checked next to "Check this box if you used a third party embodied carbon assessment tool to perform a Life Cycle Assessment on this project."

Select the LCA tool that was used to calculate the GWP values reported.

LCA Tool	
Input Options	*Description*
Athena IE	Impact Estimator for Buildings, by the Athena Sustainable Materials Institute https://www.athenasmi.org/our-software-data/impact-estimator/
TallyLCA	TallyLCA, by Building Transparency https://choosetally.com/
TallyCAT	TallyCAT, by Building Transparency https://www.buildingtransparency.org/glossary/tallycat/
Beacon	Beacon, by Thornton Tomasetti https://core-studio.gitbook.io/beacon
Quartz	Quartz Common Products Database (note: no longer updated after January 2019)
EC3	Embodied Carbon in Construction Calculator (EC3), by Building Transparency https://www.buildingtransparency.org/tools/ec3/
One Click LCA	One Click LCA, by One Click LCA Ltd
Embodied Carbon Order of Magnitude (ECOM)	Embodied Carbon Rough Order of Magnitude, https://se2050.org/ecom-tool/
eTool	eTool, by eToolLCD

LCA Tool	
Input Options	*Description*
BEAM	BEAM Estimator, by Builders for Climate Action https://www.buildersforclimateaction.org/beam-estimator.html
EPIC	EPIC has been renamed C.Scale, by Climate Scale, Inc. https://app.cscale.io/
CARE	Carbon Avoided Retrofit Estimator, by Architecture 2030 https://www.caretool.org/
Other	If “Other” is selected, please specify the method used

Select “Other” if the tool used is not listed in the drop-down menu. Properly identifying which tool was used is critical to understand underlying assumptions, data sets, and methodologies that led to the reported GWP value. It is recommended that engineers use one of the commercially-available LCA tools, as this will allow for some measure of consistency within a firm and allow for more rational comparisons across projects.

6.2 - Year Third Party Assessment was Performed

This field only appears if the box is checked next to “Check this box if you used a third party embodied carbon assessment tool to perform a Life Cycle Assessment on this project.”

Enter the year in which the LCA corresponding to the reported Embodied Carbon values was completed. It is noted that projects may go through various iterations and LCA studies at intermediate stages, the year entered here shall represent the year that the reported Embodied Carbon values are calculated.

6.3 - Project Phase

Enter the phase of the project on which the LCA is based. Select one of the following options using the dropdown:

Project Phase at LCA	
Input Options	*Description*
Concept	The concept phase includes developing the building concept, investigating its feasibility, and proposing the concept to stakeholders to make a decision to develop the concept further.
Schematic	The schematic phase includes rough drawings or a narrative that illustrate the basic concepts of the building design which most often include spatial relationships as well as basic scale and forms the owner might desire. At this time, initial descriptions of the structural, mechanical, HVAC, plumbing and electrical, interior and exterior finishes and building site are often included. The schematic phase also includes initial cost estimates.
Design Development	The design development phase involves finalizing the building design and specifying items such as materials, window and door locations and general structural details.
Construction Documents	The construction document phase includes the development of final architectural, structural, civil, mechanical, and electrical drawings to be used for construction. These drawings are in greater detail than drawings produced during design development and typically include specifications for construction details and materials.
Construction	The contractor constructs the building in accordance with the construction documents during the construction phase. The architect, engineers, and consultants perform quality control inspections, respond to Requests for Information (RFIs), review and approve technical submittals and generally ensure that the project is constructed by the contractor in accordance with the construction documents.
Completed	The contractor has completed the construction contract in accordance with the construction documents, and a Certificate of Occupancy has been issued.

6.4 - Reference Study Period (years)

The Reference Study Period is the expected building service life expressed in years and entered as a positive integer. The table below provides a summary of Reference Study Period values corresponding to LCA standards. Additional guidance regarding Reference Study Period is provided in Chapter 4, Section 4.2: “Reference Study Period Determination” of the ASCE/SEI *Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings*. Unless specifically designed for a different building service life, LCA standard, or rating system, input 60 years as the default RSP value.

Reference Study Period (years)	
Specified Inputs by various LCA standards	
75	ASTM E2921, ASHRAE 189.1
60	ISO 14040 and ISO 14044, most sustainability rating systems

6.5 - Embodied Carbon Reporting

Enter the Embodied Carbon, or GWP, value from the LCA software, tool, or spreadsheet for each life-cycle stage (A1-A3, A4, A5, B1-B2, C1-C6, D) included in the analysis. These values shall include the embodied carbon of the structural system, reported in units of kg of CO_2-equivalent (CO_2-e), for each life-cycle stage reported. At a minimum, the embodied carbon value for life-cycle stage A1-A3 (also known as cradle-to-gate) must be reported, but we highly encourage reporting all applicable life-cycle stages included in the analysis. The “Total Embodied Carbon (excluding D)” is automatically calculated in the database by adding the embodied carbon values entered for life-cycle stages A1-A3, A4, A5, B1-B5, and C1-C4. Similarly, the “Embodied Carbon Intensity (excluding D)” is automatically calculated in the database by dividing the value for the above-mentioned Total Embodied Carbon (excluding D) by the Gross Square Footage value entered by the user.

Appendix B provides clarification about how to obtain the LCA data required by SE 2050 from various LCA tools. Boxed fields shown below are for users to enter inputs. Unboxed fields are automatically calculated by the database.

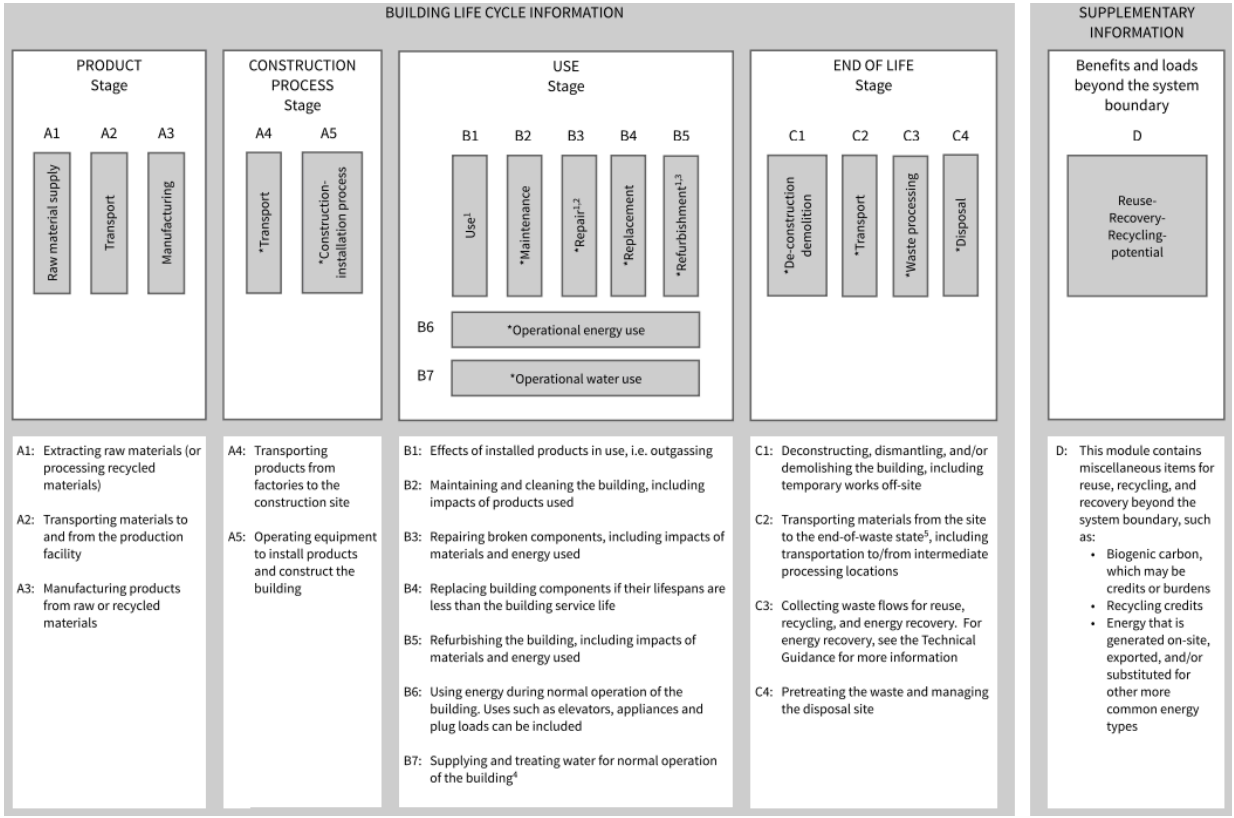
Embodied Carbon Reporting

If you used a third party embodied carbon assessment tool, please indicate your results below. If not, the A1-A3 GWP for this project calculated from steps 3-5 will be submitted as the Embodied Carbon for this project entry.

Embodied Carbon (kgCO2e)

A1-A3 (kgCO2e)	KgCO2e	For reference, the A1-A3 estimate developed from the structural material quantities you reported on steps 3-5 is: 7,730,721.41 kg CO2e
A4 [optional] (kgCO2e)	KgCO2e	
A5 [optional] (kgCO2e)	KgCO2e	
B1-B5 [optional] (kgCO2e)	KgCO2e	
C1-C4 [optional] (kgCO2e)	KgCO2e	
D [optional] (kgCO2e)	KgCO2e	
Total Embodied Carbon (excluding D)	7,730,721 kgCO2e	
Embodied Carbon Intensity (excluding D)	5,663 kgCO2e/m2	
Biogenic Carbon Content	94,239 kgCO2e	For reference, this biogenic carbon content was developed from the structural material quantities you reported in steps 3-5.
Biogenic Carbon Flow [optional] (kgCO2e)	5 KgCO2e	Biogenic Carbon Flow is different from the Biogenic Carbon Content. See User Guide for how to derive this value from third party embodied carbon assessment tools.

The following figure describes the LCA stage(s) for which users can report Embodied Carbon data:



Source: The Carbon Leadership Forum, “Life Cycle Assessment of Buildings: A Practice Guide,” (Figure 4. Standard life cycle stages and modules, adopted from EN 15978), University of Washington, June 2018. https://www.carbonleadershipforum.org/wp-content/uploads/2018/06/CLF-LCA-Practice-Guide-v1.0-2018-06-28.pdf

If your LCA Tool is Environmental Product Declarations (EPDs), EC3, or ECOM:
Enter Embodied Carbon for A1-A3 only. For other LCA Tools, refer to the tool's user documentation or detailed results for more specific guidance about the LCA stages included.

If your LCA tool includes some of the "B" stages, but not all of B1-B5:
Enter Embodied Carbon value for B1-B5. Similarly, enter GWP for the C1-C4 Embodied Carbon option if your LCA tool includes some, but not all of the "C" stages.

Biogenic Carbon Content
Some LCA tools allow the user to select whether biogenic carbon is included in the calculation of the Total Embodied Carbon or GWP value. This version of the database distinguishes between Biogenic Carbon Content and Biogenic Carbon Flow.

Unless overridden by the user, Biogenic Carbon Content is automatically calculated from the quantities of timber structural materials input in accordance with Section 4.0. Typically, the Biogenic Carbon Content per declared unit of timber products is typically provided in EPDs. In addition, EPDs of structural timber products include the assumed density, moisture content, and percentage of timber content used to estimate dry mass of timber in various structural wood and wood composite materials. Half of the dry timber mass is assumed to be carbon. Factoring the carbon mass by the 44:12 ratio of molecular carbon dioxide to atomic carbon masses yields the total biogenic carbon content in units of equivalent kilograms of carbon dioxide. The Biogenic Carbon Content values are computed in accordance with the values listed in the table below.

Timber Material Assumptions		
Material type	*Biogenic carbon content per unit of timber product*	*Units*
Softwood Lumber[1]	843	$kgCO^2/m^3$
Softwood Plywood[1]	863	$kgCO^2/m^3$
Glulam[1]	977	$kgCO^2/m^3$
Cross Laminated Timber[2]	977	$kgCO^2/m^3$
Laminated Veneer Lumber[1]	998	$kgCO^2/m^3$
Wood I-joists[1]	7.41	$kgCO^2/m$

[1] - Based on industry averages for North America, U.S., or U.S. regions. See EPD's published by the American Wood Council for additional details.

[2] - Glulam currently serves as a proxy for calculating the biogenic carbon content of CLT.

Biogenic Carbon Flow

Biogenic Carbon Flow tracks the entry and exit of biogenic carbon content in various modules of the system boundary of the life cycle. Users may determine biogenic carbon flow from third party embodied carbon assessment tools and opt to input the value in the database. For “cradle-to-gate” LCAs (considering only modules A1 through A3) or “cradle-to-construction” LCAs (considering only modules A1 through A5), the net biogenic carbon flow should be input as zero.

For “cradle-to-grave” LCAs including modules A through C, biogenic carbon flow is tracked as a negative value that offsets the embodied carbon of the timber materials during production (module A1) and as a positive value when biogenic carbon is re-emitted into the atmosphere during “end-of-life” waste processing and disposal (modules C3 and C4). For the database, enter the net flow of biogenic carbon that is re-emitted into the atmosphere during modules C3 and C4 as a positive value.

Modeling assumptions and reporting of biogenic carbon flows vary among third party LCA tools, and users should consult documentation pertinent to the software tool to understand default settings. Generally, there are three main outcomes for wood structural products at the end of life: disposal in a landfill, incineration for fuel, or wood reuse in another product. Some LCA modeling tools assume a combination of all three outcomes, based on EPA data, to determine how much biogenic carbon flows back into the atmosphere. Reporting a magnitude of biogenic carbon flow that is equal to the biogenic carbon content indicates a carbon neutral result of the life cycle, in which all biogenic carbon content returns to the atmosphere. Reporting a magnitude of biogenic carbon flow that is less than the biogenic carbon content indicates that some carbon remains permanently sequestered from the atmosphere. If the Reference Study Period is 100 years or longer in duration, the wood structure may be considered a permanent carbon sink, and the biogenic carbon flow would be zero. For further details of biogenic carbon content and biogenic carbon flow, reference the ASCE/SEI *Prestandard for Assessing the Embodied Carbon of Structural Systems for Buildings*.

Appendix A - Glossary

AHJ

The Authority Having Jurisdiction, or the AHJ, is an organization, office, or individual responsible for enforcing the requirements of a code or standard.

Biogenic Carbon Content

The quantifiable carbon content of biobased building materials, estimated as 50% elemental carbon by dry mass.

Biogenic Carbon Flow

The quantifiable flow of biogenic carbon content entering or leaving the system boundary within building materials across each lifecycle stage.

Embodied Carbon

Embodied carbon is the sum of greenhouse gas emissions released throughout the following life-cycle stages: raw material extraction, transportation, manufacturing, construction, maintenance, renovation, and end-of-life for a product or system. It is reported in terms of GWP and units of kilograms of carbon dioxide equivalent (kg-CO_2e).

Embodied Carbon Intensity

Embodied carbon intensity is the total embodied carbon of a building divided by the building floor area. In accordance with international whole building life-cycle assessment standards, it is reported in units of kilograms of carbon dioxide equivalent per square meter (kg-CO_2e/m^2).

EPD

An Environmental Product Declaration, or EPD, is a document that provides information about the life-cycle environmental impact of products or materials. EPDs are based on ISO 14025 and require third party verification. While EPDs often only report A1-A3 environmental impacts, they should be used within consideration of the full life-cycle impact of products.

Expected Building Life

The expected building life is the period of time for which the building meets or exceeds its performance requirements. It may also be known as a building's service life.

GWP

Global Warming Potential, or GWP, is the aggregation of various greenhouse gas emissions based on their relative global warming potential standardized to that of carbon dioxide. It is reported in units of kilograms of carbon dioxide equivalent (kg-CO_2e).

LCA

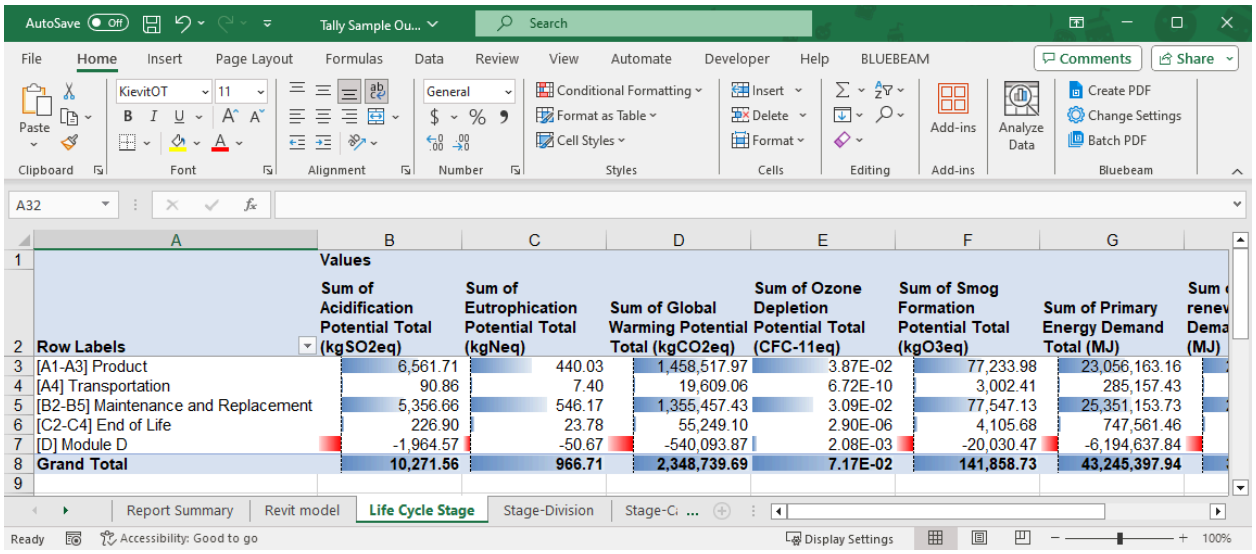
Life-Cycle Assessment, or LCA, is a method used to determine the potential environmental impacts over the life-cycle of a given material or product. When performed at the building level, this is referred to as a Whole-Building Life-Cycle Assessment (WBLCA). LCA is performed according to ISO 14040 and ISO 14044 using commercially available software.

Appendix B - Finding GWP Using LCA Tools

This section aims to help users identify, for a few common LCA tools, which numbers to report in the Global Warming Potential Input fields for each life-cycle stage.

Tally

When saving a report from Tally, it is highly recommended to check the option to save the output as a spreadsheet in addition to the pdf report. The GWP values shown alongside the various graphical outputs in the .pdf report may differ from the GWP value that should be used for input to the database, for various reasons that are outside the scope of this User Guide. In the output exported spreadsheet, find the values under *Sum of Global Warming Potential Total (kgCO2eq)* on the sheet labeled “Life Cycle Stage” in Column D as shown below:

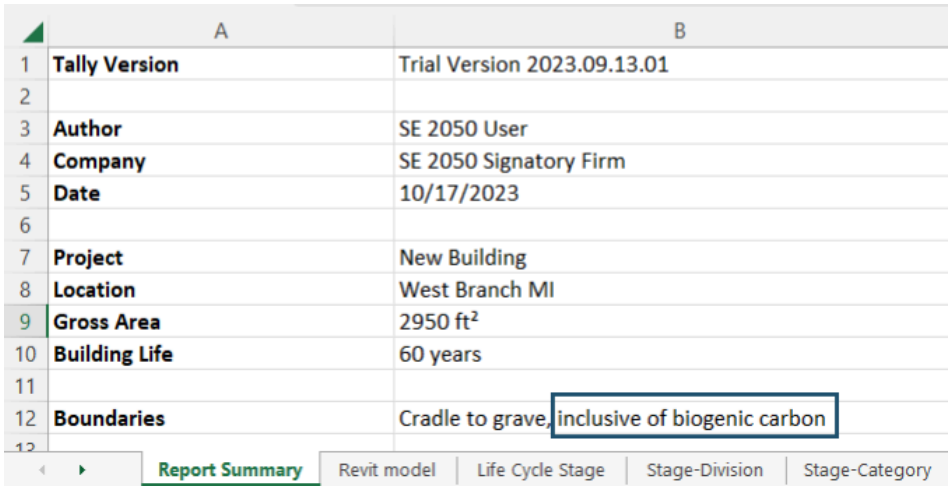


	A	B	C	D	E	F	G
1		Values					
2	Row Labels	Sum of Acidification Potential Total (kgSO2eq)	Sum of Eutrophication Potential Total (kgNeq)	Sum of Global Warming Potential Total (kgCO2eq)	Sum of Ozone Depletion Potential Total (CFC-11eq)	Sum of Smog Formation Potential Total (kgO3eq)	Sum of Primary Energy Demand Total (MJ)
3	[A1-A3] Product	6,561.71	440.03	1,458,517.97	3.87E-02	77,233.98	23,056,163.16
4	[A4] Transportation	90.86	7.40	19,609.06	6.72E-10	3,002.41	285,157.43
5	[B2-B5] Maintenance and Replacement	5,356.66	546.17	1,355,457.43	3.09E-02	77,547.13	25,351,153.73
6	[C2-C4] End of Life	226.90	23.78	55,249.10	2.90E-06	4,105.68	747,561.46
7	[D] Module D	-1,964.57	-50.67	-540,093.87	2.08E-03	-20,030.47	-6,194,637.84
8	**Grand Total**	**10,271.56**	**966.71**	**2,348,739.69**	**7.17E-02**	**141,858.73**	**43,245,397.94**
9							

On the “Life Cycle Stage” tab of the output spreadsheet, GWP values are broken down by life cycle stage.

Notes:

- Enter the Tally GWP value for “[A1-A3]” into the SE 2050 database field “A1-A3”
- Enter the Tally GWP value for “[A4]” into the SE 2050 database field “A4”
- Leave the SE 2050 database field “A5” blank
- Enter the Tally GWP value for “[B2-B5]” into the SE 2050 database field “B1-B5”
- Enter the Tally GWP value for “[C2-C4]” into the SE 2050 database field “C1-C4”
- The Report Summary tab of the output spreadsheet indicates whether the data in the spreadsheet is from an LCA with biogenic carbon included or excluded. We encourage Tally users to run the LCA twice and to report both the “Excluding Biogenic” and “Including Biogenic” data to the SE 2050 Database.

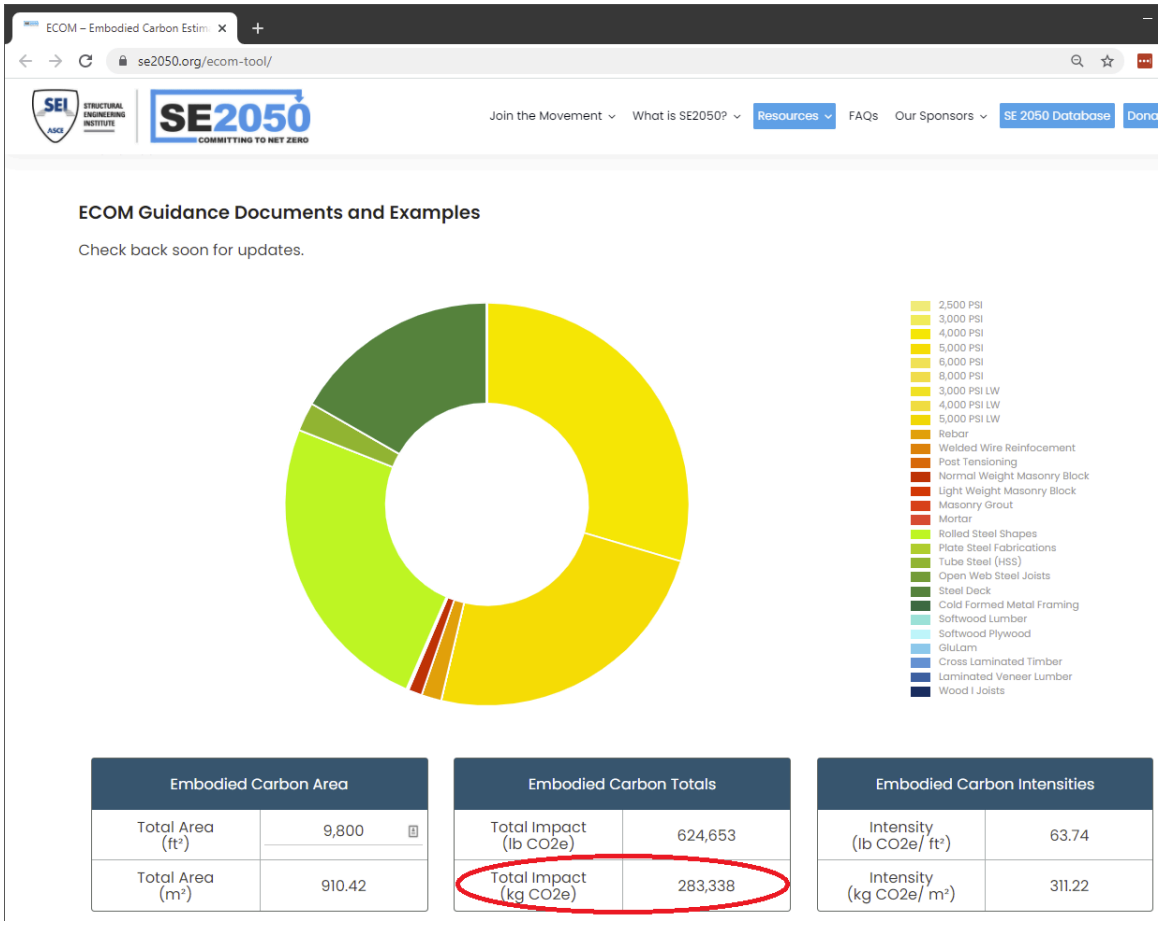


	A	B
1	**Tally Version**	Trial Version 2023.09.13.01
2		
3	**Author**	SE 2050 User
4	**Company**	SE 2050 Signatory Firm
5	**Date**	10/17/2023
6		
7	**Project**	New Building
8	**Location**	West Branch MI
9	**Gross Area**	2950 ft²
10	**Building Life**	60 years
11		
12	**Boundaries**	Cradle to grave, inclusive of biogenic carbon

Report Summary | Revit model | Life Cycle Stage | Stage-Division | Stage-Category

SE 2050 ECOM Tool

The GWP is found where shown in the screenshot below and only includes life-cycle stages A1-A3. Enter this value in the database field “A1-A3 (kgCO2e).”



One Click LCA

When using One Click LCA, the amount of embodied carbon for each of the life-cycle stage is included in the results summary. OneClick LCA offers multiple LCA options that affect how biogenic carbon is presented in the results. Please refer to OneClick LCA product documentation for more information about the reporting of biogenic carbon.

Whole-building Life Cycle Assessment, ISO 14040 & ISO 14044 (TRACI 2.1.) Download Results Summary

	Result category	Global warming kg CO2e	Ozone Depletion kg CFC11e	Acidification kg SO2e	Eutrophication kg Ne	Formation of tropospheric ozone kg O3e	Depletion of nonrenewable energy MJ	Biogenic carbon storage kg CO2e bio	
A1-A3	Construction Materials	743,355.36	0.01	1,803	7,933.2	58,701.99	5,958,958.88	0	Details
A4	Transport to the building site	16,961.85	0	52.46	12.4	1,217.54	337,392.68		Details
B3	Repair	0	0	0	0	0	0		Details
B4-B5	Material replacement and refurbishment	1,980.83	0	25.65	50.98	244.67	57,342.41		Details
C1-C4	End of life	12,027.74	0	28.31	7.76	234.74	53,141.59		Details
	Total	**774,325.77**	**0.02**	**1,909.42**	**8,004.34**	**60,398.94**	**6,406,835.57**	**0**	
	Results per denominator								
	Gross Internal Floor Area (ASHRAE) 70000.0 sq ft	11.06	0	0.03	0.11	0.86	91.53	0	

Please note. The following LCA or EPD standards are all fully compliant with the requirements of ISO 14044: ISO 14025, ISO 21930, EN15804. Assessment period fixed to 60 years.

Athena Impact Estimator

After running your model, choose “detailed measure by life cycle stage” from the report tab. Here you will find the embodied carbon values for each life-cycle stage in the Global Warming Potential row.

		PRODUCT (A1 to A3)			CONSTRUCTION PROCESS (A4 & A5)			USE (B2, B4 & B6)				END OF LIFE (C1 to C4)		
LCA Measures	**Unit**	Manufacturing	Transport	**Total**	Construction-Installation Process	Transport	**Total**	Replacement Manufacturing	Replacement Transport	Operational Energy Use Total	**Total**	De-construction, Demolition, Disposal & Waste Processing	Transport	**Total**
Global Warming Potential	kg CO2 eq	2.79E+03	5.48E+01	**2.84E+03**	2.48E+02	1.18E+02	**3.66E+02**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	1.36E+02	5.70E+01	**1.93E+02**
Acidification Potential	kg SO2 eq	7.34E+00	6.35E-01	**7.97E+00**	1.92E+00	1.14E+00	**3.06E+00**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	1.95E+00	5.48E-01	**2.49E+00**
HH Particulate	kg PM2.5 eq	1.90E+00	2.77E-02	**1.92E+00**	1.33E-01	6.27E-02	**1.95E-01**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	4.77E-02	3.04E-02	**7.81E-02**
Eutrophication Potential	kg N eq	3.19E+00	3.93E-02	**3.23E+00**	2.57E-01	7.07E-02	**3.27E-01**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	1.22E-01	3.41E-02	**1.56E-01**
Ozone Depletion Potential	kg CFC-11 eq	7.00E-05	2.01E-09	**7.00E-05**	3.50E-06	4.12E-09	**3.51E-06**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	5.94E-09	1.99E-09	**7.93E-09**
Smog Potential	kg O3 eq	1.34E+02	2.04E+01	**1.54E+02**	5.83E+01	3.59E+01	**9.42E+01**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	6.47E+01	1.73E+01	**8.20E+01**
Total Primary Energy	MJ	1.66E+04	7.83E+02	**1.74E+04**	2.45E+03	1.72E+03	**4.16E+03**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	2.03E+03	8.31E+02	**2.86E+03**
Non-Renewable Energy	MJ	1.59E+04	7.83E+02	**1.66E+04**	2.41E+03	1.72E+03	**4.12E+03**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	2.03E+03	8.31E+02	**2.86E+03**
Fossil Fuel Consumption	MJ	1.47E+04	7.81E+02	**1.55E+04**	2.35E+03	1.71E+03	**4.06E+03**	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**	2.02E+03	8.29E+02	**2.85E+03**

In previous versions of Athena IE, biogenic carbon for biobased products was found in Module D. Version 5.5 has since moved biogenic carbon out of module D and into modules of the life cycle to comply with ISO 21930. Athena IE v5.5 includes biogenic carbon in the GWP total and reports the portion of biogenic carbon contributing to GWP. Additionally, biogenic carbon flow of wood products is reported in modules A1, A3, A5, B4, C3, or C4. Generally, B4 typically only applies to non-structural wood products, such as exterior siding, roofing, and windows, that are expected to be replaced during building service life. For further details, see:

User Manual and Transparency Document, Impact Estimator for Buildings v.5.5, November 2024, Athena Sustainable Materials Institute, www.athenasmi.org [Accessed: June 6, 2025].

Appendix C - Primary Building Use Classification

Various building use classification systems were considered in creating the available list of options - primarily those used by the International Building Code (IBC), and the Commercial Buildings Energy Consumption Survey (CBECS).

The table below can be used to aid in mapping SE 2050 Use Types to IBC. CBECS is also shown for reference:

Building Use: Mapping SE 2050 to Other Categorization Systems		
SE 2050	**IBC**	**CBECS**
Office	Business	Office
Public Assembly	Assembly	Public Assembly Religious Worship
Education	Educational	Education
Industrial	Factory and Industrial	N/A
Mercantile	Mercantile	Mercantile (Enclosed and Strip Malls) Mercantile (Retail Other Than Mall) Food Sales Food Service
Multi-Family Residential	Residential	N/A
Warehouse	Storage	Warehouse and Storage
Other	Utility and Miscellaneous; High Hazard	N/A
Public Order and Safety	Institutional	Public Order and Safety
Single-Family Residential	Residential	N/A
Parking	Storage	N/A
Lodging	Residential	Lodging
Health Care	Institutional	Health Care (Inpatient) Health Care (Outpatient)
Lab	Business	Other
Data Center	Business	Other

The table below can be used to aid in mapping IBC Use Types to SE 2050 Use Types. CBECS is also shown for reference:

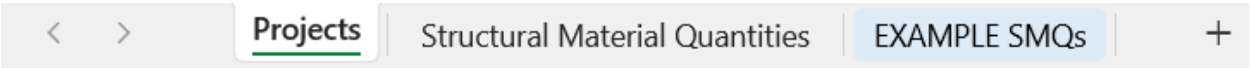
Building Use: Mapping IBC to SE 2050 to CBECS		
IBC	**SE 2050**	**CBECS**
Assembly	**Public Assembly**	Public Assembly Religious Worship
Business	**Office**	Office
	Lab **Data Center**	Other
Educational	**Education**	Education
Factory and Industrial	**Industrial**	N/A
High Hazard	**Other**	N/A
Institutional	**Public Order and Safety**	Public Order and Safety;
	Health Care	Health Care (Inpatient); Health Care (Outpatient)
Mercantile	**Mercantile**	Mercantile (Enclosed and Strip Malls); Mercantile (Retail Other Than Mall); Food Sales; Food Service;
Residential	**Single-Family Residential**	N/A
	Multi-Family Residential	N/A
	Lodging	Lodging
Storage	**Warehouse**	Warehouse and Storage
	Parking	N/A
Utility and Miscellaneous	**Other**	N/A

For additional background in building use types, refer to the following sources:

- International Building Code 2018 - Building Code Chapter 3: Occupancy Classification and Use
- Commercial Buildings Energy Consumption Survey (CBECS) https://www.eia.gov/consumption/commercial/building-type-definitions.php

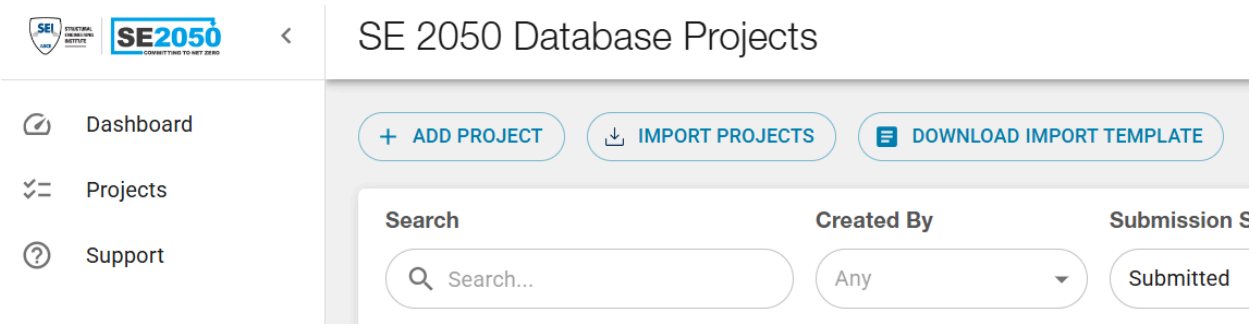
Appendix D - Using the Project Import Spreadsheet

The following provides guidance on how to use the Project Import Spreadsheet. The spreadsheet is intended to standardize the method of importing projects and save time by populating the user's projects upon upload. It is still recommended to check that all the information imported properly in the dashboard.



Projects

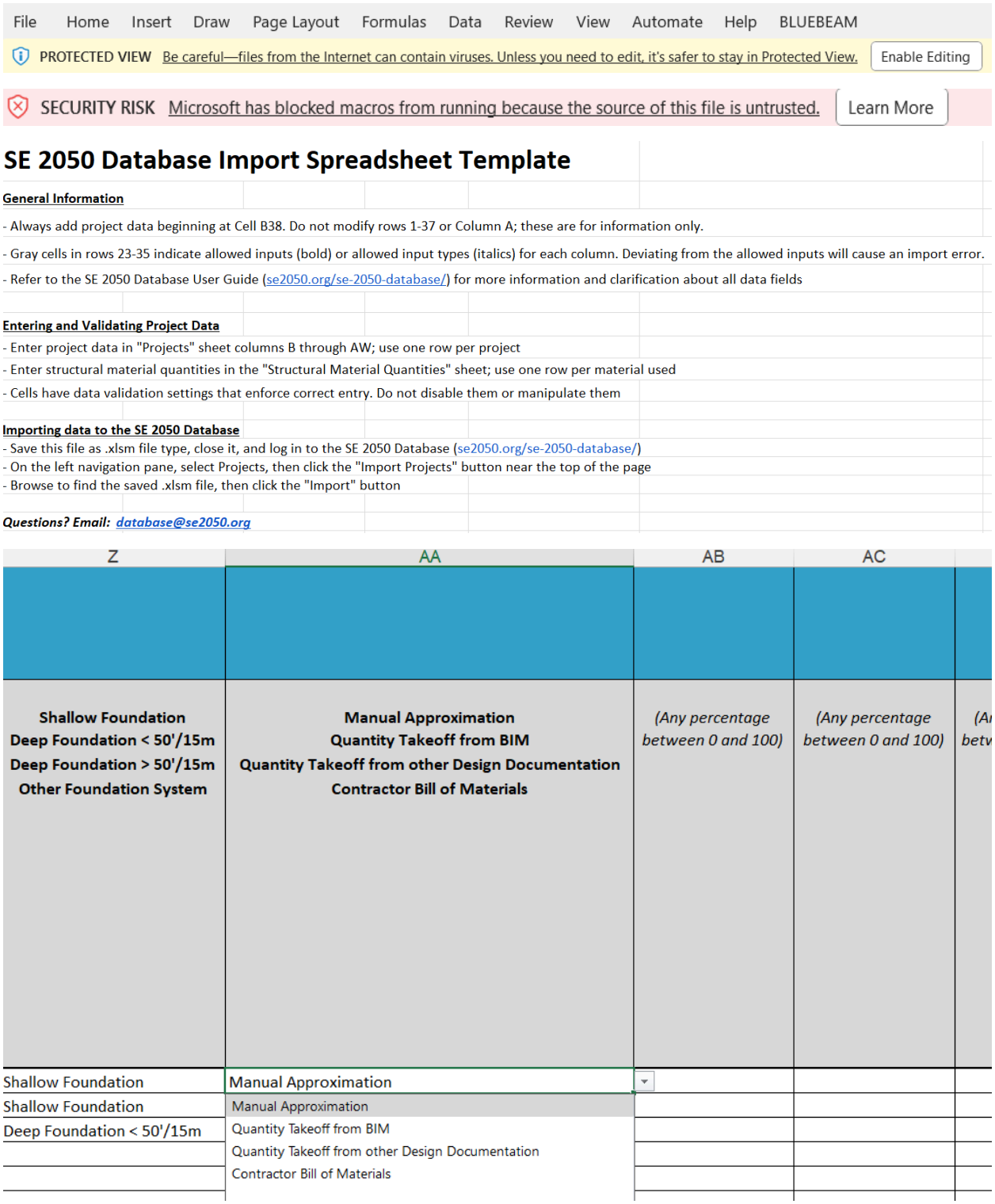
The "Projects" tab is populated with information about each project the user wishes to import that matches the fields and options available in the dashboard entry.



The User can manually enter a project by clicking "+ ADD PROJECT", which will direct to an interface of drop-down boxes and input boxes to fill in. Note that each required field must be filled in before the user can move onto the next page. There are 8 pages total before it can be submitted, but the form can be saved and exited from at any time.

Once submitted, projects can be edited or deleted at any time using the options to the right.

Another option for import is to download the import template and fill it in with project information, then upload it by pressing "IMPORT PROJECTS". Allow the file editing permissions if needed. The spreadsheet has instructions for how to fill in the fields (which match those in the database manual entry window) and how to upload when done.


File Home Insert Draw Page Layout Formulas Data Review View Automate Help BLUEBEAM
PROTECTED VIEW Be careful—files from the Internet can contain viruses. Unless you need to edit, it's safer to stay in Protected View. Enable Editing
SECURITY RISK Microsoft has blocked macros from running because the source of this file is untrusted. Learn More
SE 2050 Database Import Spreadsheet Template
General Information
- Always add project data beginning at Cell B38. Do not modify rows 1-37 or Column A; these are for information only.
- Gray cells in rows 23-35 indicate allowed inputs (bold) or allowed input types (italics) for each column. Deviating from the allowed inputs will cause an import error.
- Refer to the SE 2050 Database User Guide (se2050.org/se-2050-database/) for more information and clarification about all data fields
Entering and Validating Project Data
- Enter project data in "Projects" sheet columns B through AW; use one row per project
- Enter structural material quantities in the "Structural Material Quantities" sheet; use one row per material used
- Cells have data validation settings that enforce correct entry. Do not disable them or manipulate them
Importing data to the SE 2050 Database
- Save this file as .xlsm file type, close it, and log in to the SE 2050 Database (se2050.org/se-2050-database/)
- On the left navigation pane, select Projects, then click the "Import Projects" button near the top of the page
- Browse to find the saved .xlsm file, then click the "Import" button
Questions? Email: database@se2050.org
Z
AA
AB
AC
Shallow Foundation
Deep Foundation < 50'/15m
Deep Foundation > 50'/15m
Other Foundation System
Manual Approximation
Quantity Takeoff from BIM
Quantity Takeoff from other Design Documentation
Contractor Bill of Materials
(Any percentage between 0 and 100)
(Any percentage between 0 and 100)
Shallow Foundation
Manual Approximation
Shallow Foundation
Manual Approximation
Deep Foundation < 50'/15m
Quantity Takeoff from BIM
Quantity Takeoff from other Design Documentation
Contractor Bill of Materials

Structural Material Quantities

The next tab in the spreadsheet contains fields to describe Structural Material Quantities, which can be used to input a quantity of a specific material and get the impact from only that portion. Examples are included that correspond to the example projects. Sample materials are included to show how to include and describe that data.

Entering Project Data with optional Structural Material Quantities

- Use one row per material; in each row, select the project name from the dropdown in Column B, and enter project materials data in columns C through I.

	Project Information							
Data Field in Database:	Project Name	Overall Structure	Structure	Material Category	Material Type (Input options vary by Material)	Quantity (units vary - see previous column)	Units	Lateral Element
Allowed Inputs :	*(Dropdown list reads from Import-Projects)*	Substructure Superstructure	Foundations Foundation Walls Slabs-on-Grade Slabs/Decks Beams Columns Bracing Stairs Exterior Structural Walls Interior Structural Walls	Concrete Steel Reinforcement Masonry Steel Timber	**2500 PSI; 3000 PSI; 4000 PSI; 5000 PSI; 6000 PSI; 8000 PSI; 3000 PSI LW; 4000 PSI LW; 5000 PSI LW** *[All in units of Cubic Yards]* **Rebar; Welded Wire Reinforcement; Post Tensioning** *[All in units of Tons]* **Normal Weight Masonry Block** *[Tons]*; **Light Weight Masonry Block** *[Tons]*; **Masonry Grout** *[Cubic Yards]*; **Mortar** *[Cubic Yards]* **Rolled Steel Shapes; Plate Steel Fabrications; Tube Steel (HSS); Open Web Steel Joists; Steel Deck; Cold Formed Metal Framing** *[All in units of Tons]* **Softwood Lumber; Softwood Plywood; Glue Laminated Timber; Cross Laminated Timber; Laminated Veneer Lumber; Wood I Joists** *[All in units of Cubic Feet, Except Wood I Joists in units of LBS]*	*(Any non-negative number)*	*Will not be read into database*	*Tick box if applies Yes or No* Yes No
Sample data shown, one material per row	Sample Project 01	Substructure	Foundations	Concrete	6000 PSI	100	cyd	No
	Sample Project 01	Substructure	Foundations	Steel Reinforcement	Rebar	10	tons	No
	Sample Project 01	Substructure	Foundation Walls	Concrete	6000 PSI	100	cyd	No
	Sample Project 01	Substructure	Foundation Walls	Steel Reinforcement	Rebar	10	tons	No
	Sample Project 01	Substructure	Slabs-On-Grade	Concrete	5000 PSI	100	cyd	No
	Sample Project 01	Substructure	Slabs-On-Grade	Steel Reinforcement	Rebar	10	tons	No
	Sample Project 01	Superstructure	Slabs/Decks	Concrete	6000 PSI	1000	cyd	No
	Sample Project 01	Superstructure	Slabs/Decks	Steel Reinforcement	Post Tensioning	50	tons	No
	Sample Project 01	Superstructure	Columns	Concrete	6000 PSI	50	cyd	No
	Sample Project 01	Superstructure	Columns	Steel Reinforcement	Rebar	5	tons	No
	Sample Project 01	Superstructure	Interior Structure Walls	Concrete	8000 PSI	50	cyd	Yes

Appendix E - Complete SE 2050 SMQ Taxonomy

Copied from the "SE 2050 SMQ Taxonomy Whitepaper," Sept 2025 version

The following table presents the complete SE 2050 Structural Material Quantities (SMQ) Taxonomy from Level 1 through Level 6, providing a standardized hierarchical structure for categorizing structural components. Level 7 consists of the structural material quantities that comprise the Level 6 components. See Appendix F for more detail describing the Level 6 components and their materials, the quantities of which users are asked to enter into the SE 2050 Database for each project.

Level	Number	Name
1	**1**	**Substructure**
2	01 10	Foundations
3	**01 10 10**	**Standard Foundations**
4	01 10 10 10	Wall Foundations
5	**01 10 10 10 01**	**Foundation Walls and Footings (non-retaining)**
6	01 10 10 10 01 01	Foundation Wall (non-retaining)
6	01 10 10 10 01 02	Foundation Wall Footing (non-retaining)
6	01 10 10 10 01 03	Foundation - Walls and Footings (non-retaining) - Other
4	01 10 10 20	Column Foundations
5	**01 10 10 20 01**	**Foundation - Columns and Footings**
6	01 10 10 20 01 01	Foundation - Column Pier / Pilaster
6	01 10 10 20 01 02	Foundation - Spread Footing
6	01 10 10 20 01 03	Foundation - Columns and Footings - Other
3	**01 10 20**	**Special Foundations**

4	01 10 20 10	Driven Piles
5	**01 10 20 10 01**	**Driven Pile**
6	01 10 20 10 01 01	Driven Pile (various types)
4	01 10 20 15	Bored Piles
5	**01 10 20 15 01**	**Bored / Drilled Pile**
6	01 10 20 15 01 01	Bored Cast-in-Place (CIP) Pile
6	01 10 20 15 01 02	Auger Cast-in-Place (CIP) Pile
6	01 10 20 15 01 03	Drilled Displacement (DD) Piles
6	01 10 20 15 01 04	Drilled Shaft Piles
6	01 10 20 15 01 05	Micropile or Minipile
4	01 10 20 20	Caissons
5	**01 10 20 20 01**	**Caissons**
6	01 10 20 20 01 01	Open Caissons (Open Piers)
6	01 10 20 20 01 02	Closed Caissons (Cofferdams)
4	01 10 20 30	Special Foundation Walls
5	**01 10 20 30 01**	**Special Foundation Walls**
6	01 10 20 30 01 01	Special Foundation Wall
4	01 10 20 40	Foundation Anchors
5	**01 10 20 40 01**	**Foundation Anchors**
6	01 10 20 40 01 01	Mechanical Rock Anchors
6	01 10 20 40 01 02	Grouted Rock Anchors
6	01 10 20 40 01 03	Post-Tensioned Rock Anchors

6	01 10 20 40 01 04	Multi-Strand Rock Anchors
6	01 10 20 40 01 05	Passive Rock Anchors
4	01 10 20 50	Underpinning
5	**01 10 20 50 01**	**Underpinning**
6	01 10 20 50 01 01	Underpinning
4	01 10 20 60	Raft Foundations
5	**01 10 20 60 01**	**Raft / Mat Foundation**
6	01 10 20 60 01 01	Raft / Mat Foundation
4	01 10 20 70	Pile Caps
5	**01 10 20 70 01**	**Pile Cap**
6	01 10 20 70 01 01	Pile Cap
4	01 10 20 80	Grade Beams
5	**01 10 20 80 01**	**Grade Beam**
6	01 10 20 80 01 01	Grade Beam
2	01 20	Subgrade Enclosures
3	**01 20 10**	**Walls for Subgrade Enclosures**
4	01 20 10 10	Subgrade Enclosure Wall Construction
5	**01 20 10 10 01**	**Subgrade Enclosure Foundation Wall and Footing (retaining)**
6	01 20 10 10 01 01	Subgrade Enclosure Foundation Wall (retaining)
6	01 20 10 10 01 02	Subgrade Enclosure Foundation Wall Footing (retaining)

2	01 40	Slabs-on-Grade
3	**01 40 10**	**Standard Slabs-on-Grade**
4	01 40 10 01	Standard Slabs-on-Grade
5	**01 40 10 01 01**	**Standard Slab-on-Grade**
6	01 40 10 01 01 01	Standard Slab-on-Grade
6	01 40 10 01 01 02	Topping Slab
6	01 40 10 01 01 03	Housekeeping Pad
3	**01 40 20**	**Structural Slabs-on-Grade**
4	01 40 20 01	Structural Slabs-on-Grade
5	**01 40 20 01 01**	**Structural Slab-on-Grade**
6	01 40 20 01 01 01	Structural Slab-on-Grade
1	**2**	**Shell**
2	02 10	Superstructure
3	**02 10 10**	**Floor Construction**
4	02 10 10 10	Floor Structural Frame
5	**02 10 10 10 01**	**Column**
6	02 10 10 10 01 01	Column
6	02 10 10 10 01 02	Built-up or Composite Colum
6	02 10 10 10 01 03	Column - Other
5	**02 10 10 10 02**	**Beam**

6	02 10 10 10 02 01	Beam
6	02 10 10 10 02 02	Built-up or Composite Beam
6	02 10 10 10 02 03	Truss
6	02 10 10 10 02 04	Joist
6	02 10 10 10 02 05	Beam - Other
5	**02 10 10 10 03**	**Bracing**
6	02 10 10 10 03 01	Bracing - Vertical
6	02 10 10 10 03 02	Bracing - Horizontal
6	02 10 10 10 03 03	Bracing - Other
5	**02 10 10 10 04**	**Interior Walls**
6	02 10 10 10 04 01	Interior Wall - Bearing Wall
6	02 10 10 10 04 02	Interior Wall - Shear Wall
6	02 10 10 10 04 03	Interior Wall - Insulated Panel Wall (load bearing)
6	02 10 10 10 04 04	Interior Wall - Other
5	**02 10 10 10 05**	**Supplemental Floor Structural Frame**
6	02 10 10 10 05 01	Façade Support Framing
6	02 10 10 10 05 02	Elevator Framing and Support
6	02 10 10 10 05 03	Hung Pit/Elevator Pit Framing
6	02 10 10 10 05 04	Supplemental Framing - Other
4	02 10 10 20	Floor Decks, Slabs, and Toppings
5	**02 10 10 20 01**	**Floor Decks, Slabs, and Toppings**
6	02 10 10 20 01 01	Slab - Flat Plate and Flat Slab (Mild Reinforcement)
6	02 10 10 20 01 02	Slab - Flat Plate and Flat Slab (Post-Tensioned)

6	02 10 10 20 01 03	Floor Deck - Composite Concrete Topping on Metal Deck
6	02 10 10 20 01 04	Floor Deck - Bare Metal Deck
6	02 10 10 20 01 05	Floor Deck - Planks and Panels
6	02 10 10 20 01 06	Slabs - Topping Slabs (For Strength and Serviceability)
6	02 10 10 20 01 07	Decks, Slabs, and Toppings - Other
3	**02 10 20**	**Roof Construction**
4	02 10 20 10	Roof Structural Frame
5	**02 10 20 10 01**	**Columns Supporting Roof**
6	02 10 20 10 01 01	Column Supporting Roof
6	02 10 20 10 01 02	Built-up or Composite Column Supporting Roof
6	02 10 20 10 01 03	Column - Other Supporting Roof
5	**02 10 20 10 02**	**Beams Supporting Roof**
6	02 10 20 10 02 01	Beam Supporting Roof
6	02 10 20 10 02 02	Built-up or Composite Beam Supporting Roof
6	02 10 20 10 02 03	Truss Supporting Roof
6	02 10 20 10 02 04	Joist Supporting Roof
6	02 10 20 10 02 05	Beam - Other Supporting Roof
5	**02 10 20 10 03**	**Roof Bracing**
6	02 10 20 10 03 01	Roof Bracing - Vertical
6	02 10 20 10 03 02	Roof Bracing - Horizontal
6	02 10 20 10 03 03	Roof Bracing - Other
5	**02 10 20 10 04**	**Roof Interior Wall**

6	02 10 20 10 04 01	Interior Wall - Bearing Wall Supporting Roof
6	02 10 20 10 04 02	Interior Wall - Shear Wall Supporting Roof
6	02 10 20 10 04 03	Interior Wall - Insulated Panel Wall Supporting Roof (load bearing)
6	02 10 20 10 04 04	Interior Wall - Other Supporting Roof
5	**02 10 20 10 05**	**Supplemental Roof Structural Frame**
6	02 10 20 10 05 01	Roof Façade Support Framing
6	02 10 20 10 05 02	Roof Elevator Framing and Support
6	02 10 20 10 05 03	Roof Hung Pit / Elevator Pit Framing
4	02 10 20 20	Roof Decks, Slabs, and Toppings
5	**02 10 20 20 01**	**Roof Decks, Slabs, and Toppings**
6	02 10 20 20 01 01	Roof Slab - Flat Plate and Flat Slab (Mild Reinforcement)
6	02 10 20 20 01 02	Roof Slab - Flat Plate and Flat Slab (Post-Tensioned)
6	02 10 20 20 01 03	Roof Floor Deck - Composite Concrete Topping on Metal Deck
6	02 10 20 20 01 04	Roof Floor Deck - Bare Metal Deck
6	02 10 20 20 01 05	Roof Floor Deck - Planks and Panels
6	02 10 20 20 01 06	Roof Slabs - Topping Slabs (For Strength and Serviceability)
6	02 10 20 20 01 07	Roof Decks, Slabs, and Toppings - Other
3	**02 10 80**	**Stair Construction**
4	02 10 80 10	Stair Construction
5	**02 10 80 10 01**	**Stairs**
6	02 10 80 10 01 01	Stair Framing / Ornamental Stair Framing

3	**02 20 10**	**Exterior Walls**
4	02 20 10 20	Exterior Wall Construction
5	**02 20 10 20 01**	**Exterior Walls**
6	02 20 10 20 01 01	Exterior Wall - Bearing Wall
6	02 20 10 20 01 02	Exterior Wall - Shear Wall
6	02 20 10 20 01 03	Exterior Wall - Insulated Panel Wall (load bearing)
6	02 20 10 20 01 04	Exterior Wall - Other
5	**02 20 10 20 02**	**Exterior Walls Supporting Roof**
6	02 20 10 20 02 01	Exterior Wall Supporting Roof- Bearing Wall
6	02 20 10 20 02 02	Exterior Wall Supporting Roof - Shear Wall
6	02 20 10 20 02 03	Exterior Wall Supporting Roof - Insulated Panel Wall (load bearing)
6	02 20 10 20 02 04	Exterior Wall Supporting Roof - Other

Appendix F - Assembly Definitions and SEI Prestandard Components Categories

Copied from Appendix B of the "SE 2050 SMQ Taxonomy Whitepaper," Sept 2025

This appendix presents a structured breakdown of Level 5 Assemblies of the SMQ Taxonomy along with their corresponding Level 6 Components and Level 7 Materials / Products. It provides clearer definitions and distinctions between related structural assemblies to support consistent interpretation and classification.

Each table includes illustrative examples of Primary, Accessory, Ancillary, and Excluded components. These categories align with the intent of the SEI Prestandard and are provided to show classification scope and usage context. However, they should be viewed as illustrative only and not as exhaustive lists. Furthermore, while Level 7 lists materials using MasterFormat Divisions, more detailed specification is necessary to associate the collected structural material quantities with embodied carbon factors, or environmental impacts in an LCA. See Example: Built-Up Steel Column for more detailed example of how to use Level 7.

Exercising engineering judgment is still important. For instance, a pipe sleeve may include flanges or connectors that could theoretically be further subdivided, but in practice, such items often come as pre-manufactured assemblies with a single Environmental Product Declaration (EPD), making further breakdown unnecessary or even misleading.

While discrepancies between structural material detailing and embodied carbon accounting may arise, Level 7 provides a consistent, actionable foundation for applying component type classifications and improving the precision of material takeoffs.

Level	Function[1]		
5	**Assembly**		
	01 10 10 10 01 Foundation Walls and Footings (non-retaining)		
6	**Component**		
	Primary - Included for all SEI Prestandard Assessment Tiers **01 10 10 10 01 01 Foundation Wall (non-retaining)** **01 10 10 10 01 02 Foundation Wall Footing (non-retaining)** **01 10 10 10 01 03 Foundation Walls and Footings – Other**		
	A non-retaining foundation wall is typically constructed of reinforced concrete and cast-in-place on site using temporary formwork. It supports vertical loads, such as façade or perimeter wall loads, and is not designed to resist lateral soil pressure, as soil exists on both sides of the wall. These walls are commonly topped with a slab-on-grade. In colder climates, they are often referred to as “frost walls” due to their role in extending below the frost line. The wall typically bears on a spread footing, which is also constructed of reinforced concrete and is generally a few feet wide, running concentric with the base of the wall. This footing distributes the vertical loads from the wall to the underlying soil.		
	Included or Optional per SEI Prestandard Assessment Tier		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Masonry mortar; Stone mortar; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete Div 04: Stone, Masonry Block and Grout Div 05: Steel Reinforcement and Tendons		
5	**Assembly**		
	01 10 10 20 01 Foundation – Columns and Footings		
6	**Component**		
	Primary **01 10 10 20 01 01 Foundation – Column Pier / Pilaster** **01 10 10 20 01 02 Foundation – Spread Footing** **01 10 10 20 01 03 Foundation – Columns and Footings – Other**		

	These foundation elements are typically constructed of reinforced concrete and cast-in-place on site using formwork. A column pier is a vertical structural element, typically isolated, that transfers loads from a column down to a spread footing. It is aligned along the column line and is commonly used in shallow foundation systems. When this type of vertical element is partially or fully embedded within a foundation wall, it is referred to as a pilaster. Pilasters serve the same load-transferring function but are integrated into the wall, often to provide additional thickness and bearing capacity at column locations. The footing beneath a column pier or pilaster is typically a square spread footing, centered concentric with the column, and sized to distribute the vertical loads to the underlying soil within allowable bearing pressures.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Masonry mortar; Stone mortar; Other;	Elevator support;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete Div 04: Stone, Masonry Block and Grout Div 05: Steel Reinforcement		
5	**Assembly**		
	01 10 20 10 01 Driven Pile		
6	**Component**		
	Primary **01 10 20 10 01 01 Driven Pile (various types)**		
	A driven pile is a deep foundation element installed by mechanically driving it into the ground using a pile driver or similar equipment. It transfers structural loads to deeper, more stable soil strata or bedrock, bypassing weaker or compressible near-surface soils.		
	Accessory	Ancillary	Excluded
	Cap plates; Supplemental reinforcement; Rebar couplers; Other;		Temporary guide support;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Structural Steel, Steel Reinforcement and Tendons		

	Div 06: Timber		
5	**Assembly**		
	01 10 20 15 01 Bored / Drilled Pile		
6	**Component**		
	Primary **01 10 20 15 01 01 Bored Cast-in-Place (CIP) Pile** **01 10 20 15 01 02 Auger Cast-in-Place (CIP) Pile** **01 10 20 15 01 03 Drilled Displacement (DD) Piles** **01 10 20 15 01 04 Drilled Shaft Piles** **01 10 20 15 01 05 Micropile or Minipile**		
	Bored or drilled pile foundations are deep foundation systems formed by creating a cylindrical hole in the ground and placing concrete or grout (typically with reinforcement) to construct a cast-in-place structural element. These systems are used to transfer loads to deeper, competent soil or rock layers, especially where surface soils are weak or compressible. Compared to driven piles, they generate minimal vibration and are well-suited for constrained or sensitive sites. ● Bored Cast-in-Place (CIP) Piles – Drilled and filled with reinforcement and concrete; often supported with casing or slurry. ● Auger Cast-in-Place (CIP) Piles – Installed using a continuous flight auger with grout or concrete injected as the auger is withdrawn. ● Drilled Displacement (DD) Piles – Use a displacement tool to laterally compact soil and are filled with concrete as the tool is removed. ● Drilled Shaft Piles – Large-diameter piles used for heavy loads, often with slurry or casing during excavation. ● Micropiles (Minipiles) – Small-diameter, high-capacity piles installed by rotary drilling and pressure grouting, ideal for retrofit and limited-access sites		
	Accessory	**Ancillary**	**Excluded**
	Cap plates; Supplemental reinforcement; Rebar couplers; Other;		Temporary guide support;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete Div 05: Structural Steel, Steel Reinforcement and Tendons		
5	**Assembly**		
	01 10 20 20 01 Caissons		
6	**Component**		
	Primary **01 10 20 20 01 01 Open Caissons (Open Piers)** **01 10 20 20 01 02 Closed Caissons (Cofferdams)**		

	Caisson foundations are large, watertight, deep foundation systems used to support heavy loads in challenging soil or water conditions, such as for bridges and marine structures. They are typically constructed at the surface and lowered into position by excavation or weight. This assembly includes: ● Open Caissons (Open Piers): Hollow, open-top and bottom structures sunk by internal excavation; often filled with concrete once in place. ● Closed Caissons (Cofferdams): Watertight enclosures, dewatered after installation to allow dry construction of foundations below water or unstable soil.		
	Accessory	**Ancillary**	**Excluded**
	Cap plates; Supplemental reinforcement; Rebar couplers; Other;		Temporary guide support;
7	**Component**		
	Div 03: Concrete Div 05: Steel Reinforcement		
5	**Assembly**		
	01 10 20 30 01 Special Foundation Walls		
6	**Component**		
	Primary **01 10 20 30 01 01 Special Foundation Wall**		
	A special foundation wall is a structural wall element that does not fall within standard retaining or non-retaining categories and is used to address unique loading, geotechnical, or constructability conditions. These may include walls designed for seismic isolation, vibration mitigation, deep excavation support, or integration with shoring or hybrid systems.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Masonry mortar; Stone mortar; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone, Masonry Block and Grout Div 05: Structural Steel, Steel Reinforcement and Tendons, Aluminum Div 06: Timber		
5	**Assembly**		

	01 10 20 40 01 Foundation Anchors		
6	**Component**		
	Primary **01 10 20 40 01 Mechanical Rock Anchors** **01 10 20 40 02 Grouted Rock Anchors** **01 10 20 40 03 Post-Tensioned Rock Anchors** **01 10 20 40 04 Multi-Strand Rock Anchors** **01 10 20 40 05 Passive Rock Anchors**		
	Foundation anchors are structural elements used to transfer tension forces from a structure into competent rock or soil, providing stability against uplift, sliding, or overturning. They are commonly used in retaining systems, deep foundations, slope stabilization, and structures subject to lateral or uplift forces. Anchors are typically installed in pre-drilled holes and can be mechanical, grouted, or post-tensioned, depending on performance and load requirements. This assembly class includes: ● Mechanical Rock Anchors – Anchors that engage rock through mechanical expansion at the tip. ● Grouted Rock Anchors – Anchors bonded to rock using cementitious or resin grout. ● Post-Tensioned Rock Anchors – Grouted anchors tensioned after installation to apply active force. ● Multi-Strand Rock Anchors – High-capacity, post-tensioned anchors made of multiple steel strands. ● Passive Rock Anchors – Anchors that develop tension only in response to structural or ground movement (no active stressing).		
	Accessory	**Ancillary**	**Excluded**
			Temporary guide support;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Anchor Grout Div 05: Structural Steel, Steel Reinforcement and Tendons		
5	**Assembly**		
	01 10 20 50 01 Underpinning		
6	**Component**		
	Primary **01 10 20 50 01 01 Underpinning**		
	Underpinning is a construction technique used to strengthen, stabilize, or extend the depth of an existing foundation. It is typically employed when a building's original foundation is inadequate due to changes in load, soil conditions, nearby excavation, or structural settlement. Underpinning methods vary and may include mass concrete piers, micropiles, needle beams, or jet grouting. The goal is to transfer building loads to deeper, more stable strata or to increase foundation capacity without disturbing the existing structure.		

	Accessory	Ancillary	Excluded
			Temporary guide support;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone, Masonry Block and Grout Div 05: Structural Steel, Steel Reinforcement and Tendons Div 06: Timber		
5	**Assembly**		
	01 10 20 60 01 Raft / Mat Foundations		
6	**Component**		
	Primary **01 10 20 60 01 01 Raft / Mat Foundation**		
	A raft foundation (also known as a mat foundation) is a large, thick concrete slab that supports multiple columns or an entire structure across a broad area, distributing loads evenly to the underlying soil. It is typically used where soil bearing capacity is low or where differential settlement must be minimized. Raft foundations can be flat, ribbed, or cellular in form, and often incorporate significant reinforcement. They are commonly used in mid- to high-rise buildings, tanks, silos, and sites with poor or variable subsurface conditions.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Steel Reinforcement and Tendons		
5	**Assembly**		
	01 10 20 70 01 Pile Cap		
6	**Component**		
	Primary **01 10 20 70 01 01 Pile Cap**		
	A pile cap is a reinforced concrete element that sits atop a group of piles, distributing structural loads from columns, walls, or slabs to the piles below. It acts as a load-transfer platform, tying multiple piles together to function as a single foundation		

	unit. Pile caps are designed to spread loads evenly, ensure structural continuity, and provide rigidity to the pile group.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Stone mortar; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone Div 05: Steel Reinforcement and Tendons		
5	**Assembly**		
	01 10 20 80 01 Grade Beam		
6	**Component**		
	Primary **01 10 20 80 01 01 Grade Beam**		
	A grade beam is a horizontal structural element, typically made of reinforced concrete, that spans between foundation supports such as piers, piles, or footings at or near ground level. It is designed to carry and transfer loads from above-grade walls or columns to these supports, often across soil conditions that do not allow for continuous wall footings. Unlike ground-supported footings, grade beams are designed to span and resist bending between supports. They may be cast integrally with a slab-on-grade or constructed as a standalone element using concrete, steel, or other structural materials, depending on project requirements.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Stone mortar; Other;	Elevator support;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Steel Reinforcement and Tendons		
5	**Assembly**		

	01 20 10 10 01 Subgrade Enclosure Foundation Wall and Footings (retaining)		
6	**Component**		
	Primary **01 20 10 10 01 01 Subgrade Enclosure Foundation Wall (retaining)** **01 20 10 10 01 02 Subgrade Enclosure Foundation Wall Footing (retaining)**		
	This assembly includes retaining walls and associated footings that form part of a shallow foundation system, typically used in basement construction. These elements are designed to resist both vertical structural loads and lateral earth pressures from retained soil. ● Subgrade Enclosure Foundation Wall (retaining) A vertical structural wall, typically cast-in-place reinforced concrete, that retains soil on one side while supporting superstructure loads. Commonly used to form basement or subgrade levels in buildings, these walls often also serve as part of the building envelope and may include waterproofing or insulation. ● Subgrade Enclosure Foundation Wall Footing (retaining) A spread footing located beneath the retaining wall that distributes vertical and lateral loads to the underlying soil. These footings are typically wider than the wall itself and may include keying or shear elements to resist sliding and overturning due to soil pressure.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Masonry mortar; Stone mortar; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Enclosure materials; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone, Masonry Block and Grout Div 05: Steel Reinforcement and Tendons		
5	**Assembly**		
	01 40 10 01 01 Standard Slab-on-Grade		
6	**Component**		
	Primary **01 40 10 01 01 01 Standard Slab-on-Grade** **01 40 10 01 01 02 Topping Slab** **01 40 10 01 01 03 Housekeeping Pad**		

	This assembly class includes cast-in-place concrete slab systems placed directly on the ground and designed to transfer building loads to the supporting soil or base layer. Slab-on-grade systems are typically used for ground-level floors in buildings and may include structural or non-structural applications, depending on reinforcement and loading conditions. This class includes: ● Standard Slab-on-Grade: A reinforced or unreinforced concrete slab poured directly on compacted subgrade or granular base, typically used for ground floors in buildings, warehouses, and garages. ● Topping Slab: A thin concrete overlay placed on an existing slab or structural deck to provide a finished surface, increase elevation, or enhance durability. ● Housekeeping Pad: A small, isolated concrete pad placed on top of a slab or foundation to support mechanical or electrical equipment, typically raised to protect from washdown or spills.		
	Accessory	**Ancillary**	**Excluded**
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Steel Reinforcement and Tendons, Aluminum		
5	**Assembly**		
	01 40 20 01 01 Structural Slab-on-Grade		
6	**Component**		
	Primary **01 40 20 01 01 01 Structural Slab-on-Grade**		
	A structural slab-on-grade, also known as a framed slab, is a reinforced concrete slab designed to act as a self-supporting structural element. Unlike standard slabs that rely on continuous support from the subgrade, structural slabs span between grade beams, pile caps, or other foundation elements, and are engineered to carry loads through bending and shear. These slabs are typically used where the underlying soil is not capable of providing uniform support, as in areas with expansive soils, voids, trenches, or with differential settlement risk. They are common in industrial buildings, utility areas, and structures with heavy point loads or poor subgrade conditions. Structural slabs often incorporate dense reinforcement, thickened sections, or are integrated into pile-supported systems.		

	Accessory	Ancillary	Excluded
	Embedded steel elements; Secondary reinforcement around openings or through cold joints; Rebar couplers; Other;	Elevator support; Pit grating;	Pipe sleeves; Insulation; Waterproofing; Vapor barriers; Waterstops; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Structural Steel, Steel Reinforcement and Tendons, Aluminum		
5	**Assembly**		
	02 10 10 10 01 Column		
6	**Component**		
	Primary **02 10 10 10 01 01 Column** **02 10 10 10 02 Built-up or Composite Column** **02 10 10 10 03 Column – Other**		
	This assembly class includes vertical structural elements designed primarily to transfer axial loads from beams, slabs, or other superstructure components down to the foundation. Columns are essential for carrying gravity loads and, in many cases, also contribute to lateral stability.[2] This class includes: ● Column: A single-material vertical element, typically made of reinforced concrete, structural steel, or heavy timber, designed to carry compressive loads. ● Built-up or Composite Column: A column composed of two or more materials acting together (e.g., concrete-filled steel tube or steel-reinforced concrete), or assembled from multiple components (e.g., laced or battened steel members). Used where increased capacity, ductility, or fire resistance is required. ● Column – Other: Includes non-standard or specialized column types not classified above, such as architectural-integrated columns, temporary shoring columns, or columns with atypical geometry or materials.		
	Accessory	**Ancillary**	**Excluded**
	Baseplates; Secondary reinforcement; Splice plates and channels; Anchor rods; Baseplate grout bed; Screws and nails; Bolts; Headed shear connectors;	Façade connections; Elevator support; Canopy support; Other;	Fireproofing; Safety cables; Pipe sleeves; Insulation; Formwork; Other;

	Blocking; Other;		
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone, Masonry Block and Grout Div 05: Structural Steel, Steel Reinforcement and Tendons, Aluminum Div 06: Timber		
5	**Assembly**		
	02 10 10 10 02 Beam		
6	**Component**		
	Primary **02 10 10 10 02 01 Beam** **02 10 10 10 02 02 Built-up or Composite Beam** **02 10 10 10 02 03 Truss** **02 10 10 10 02 04 Joist** **02 10 10 10 02 05 Beam – Other**		
	This assembly class includes horizontal or sloped structural framing elements that primarily resist bending and shear forces. Beams transfer loads from floors, roofs, or secondary framing elements to vertical supports such as columns or walls. They can be constructed from a wide range of materials and configurations depending on structural demands, span length, and construction method. This class includes: ● Beam: A conventional single-material element, such as a steel wide-flange beam, reinforced concrete beam, or sawn lumber beam, designed to support loads through flexure. ● Built-up or Composite Beam: A beam constructed from multiple components or materials acting together (e.g., laminated timber, flitch beams, or steel-concrete composite beams) to achieve enhanced structural capacity or performance. ● Truss: A structural assembly composed of interconnected members arranged in triangular units to efficiently carry loads through axial forces. Trusses are used to span large distances with minimal material. ● Joist: A lightweight, standardized steel truss-like element typically used in floor and roof framing, designed for efficient material use and ease of MEP integration. ● Beam – Other: Non-standard or specialized beam types not covered above, including transfer girders, shelf angles acting as structural elements, or beams with unconventional geometry or detailing.		
	Accessory	**Ancillary**	**Excluded**

	Embedded steel elements; Secondary reinforcement; Connection materials; Splice channels; Splice plates; Bearing plates; Screws and nails; Bolts; Headed shear connectors; Knife plates; Blocking; Other	Façade connections; Elevator support; Canopy support; Other;	Fireproofing; Acoustic materials; Safety cables; Pipe sleeves; Insulation; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 04: Stone, Masonry Block and Grout Div 05: Structural Steel, Steel Reinforcement and Tendons, Aluminum Div 06: Timber		
5	**Assembly**		
	02 10 10 10 03 Bracing		
6	**Component**		
	Primary **02 10 10 10 03 01 Bracing – Vertical** **02 10 10 10 03 02 Bracing – Horizontal** **02 10 10 10 03 03 Bracing – Other**		
	This assembly class includes structural elements that provide stability to a building or structure by resisting lateral loads such as wind, seismic forces, or unbalanced loading. Bracing systems function primarily through axial tension and compression and are critical to the overall lateral force-resisting system. This class includes: ● Bracing – Vertical: Diagonal or cross-bracing elements located in vertical planes (e.g., between floors or in walls) that resist lateral loads and control building sway. Common types include steel rod, angle, or HSS bracing in X, K, or Chevron configurations. ● Bracing – Horizontal: Elements installed in horizontal planes (e.g., roof or floor diaphragms) to distribute lateral forces and maintain frame geometry. Often used in conjunction with deck diaphragms or trusses. ● Bracing – Other: Includes specialized or non-standard bracing systems not classified above, such as buckling-restrained braces (BRBs), tension-only systems, or architectural-integrated bracing.		
	Accessory	**Ancillary**	**Excluded**

	Secondary reinforcement; Connection materials; Gusset plates; Splice plates and channels; Headed shear connectors; Knife plates; Screws and nails; Bolts; Strapping; Other	Façade connections; Elevator support; Canopy support; Other;	Acoustic materials; Safety cables; Pipe sleeves; Insulation; Formwork; Other;
7	**Material / Product (MasterFormat)**		
	Div 03: Concrete, Precast Concrete Div 05: Structural Steel, Steel Reinforcement and Tendons, Aluminum Div 06: Timber		