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CITA

Using the Revit Energy Analytical Model for Total Carbon Analysis from Concept to Detailed Design



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- Façade Design Applications
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10+ Years as Director in Architectural Firm

LEED Green Associate



Overview

Understand the Revit Energy Analytical Model, the problems it solves and how it is used for Total Carbon analysis.

Learn step by step workflows for creating, viewing and checking the Energy Analytical Model from Concept to Detailed design.

Hear about FenestraPro's experience with designers on overcoming key barriers, and adding value to what Revit offers today.

Discover the future of these tools and workflows and provide input the Autodesk and FenestraPro development teams.

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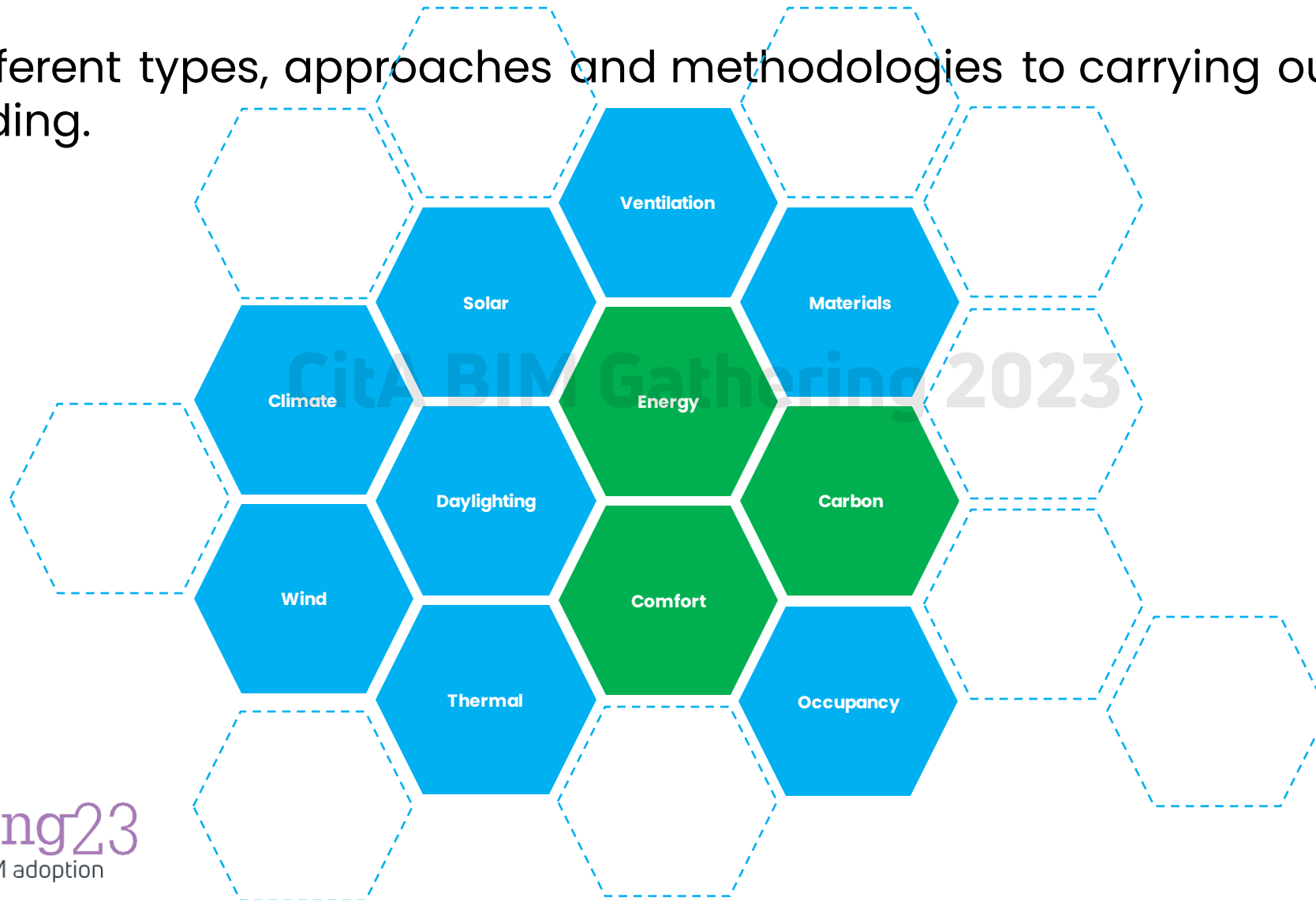
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Building Energy Analysis

Is there ever a 'right' answer?

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Many different types, approaches and methodologies to carrying out an '**analysis**' of a building.

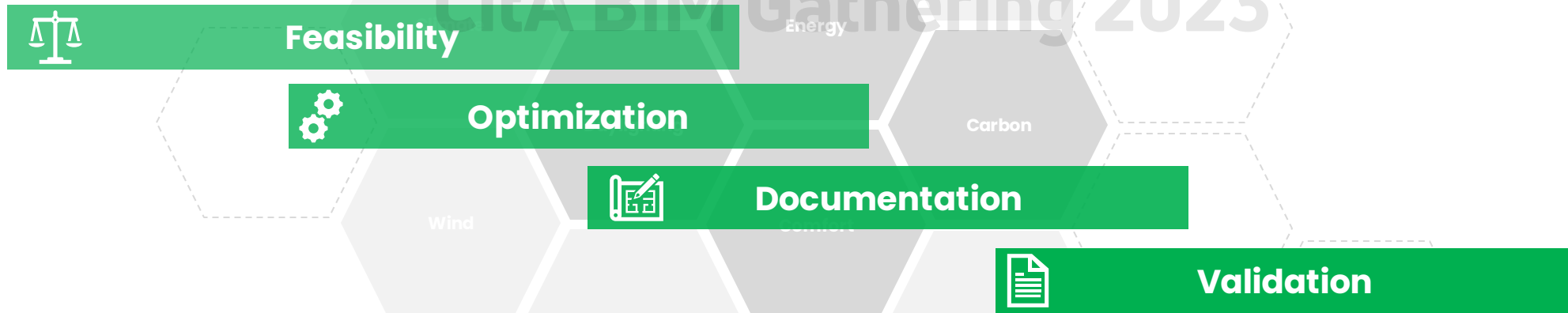


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Level of Detail



Analysis Type



Stage



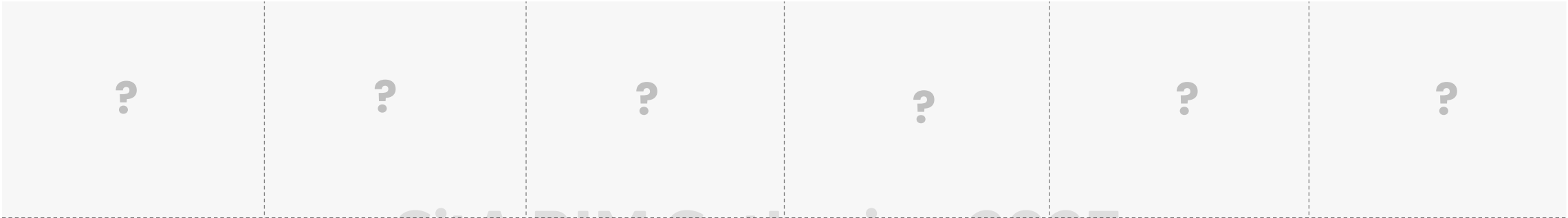
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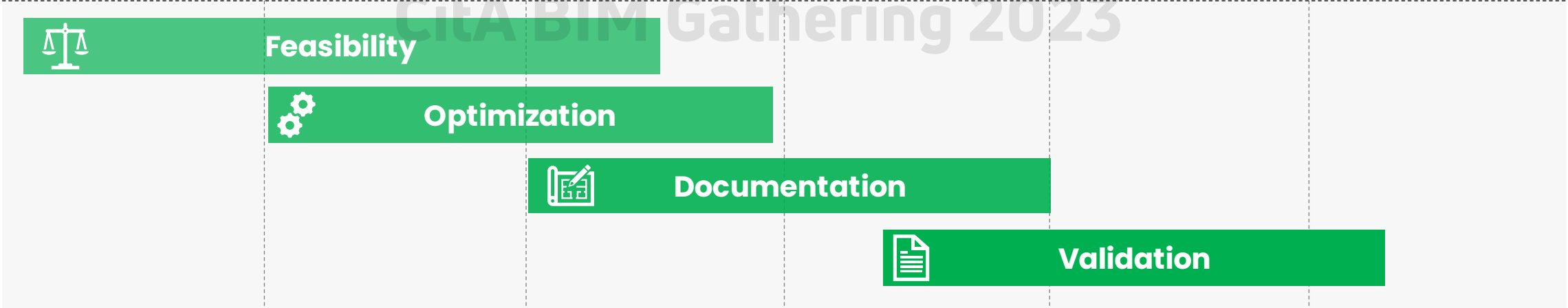
Level of Detail



EAM Mode



Analysis Type



Stage



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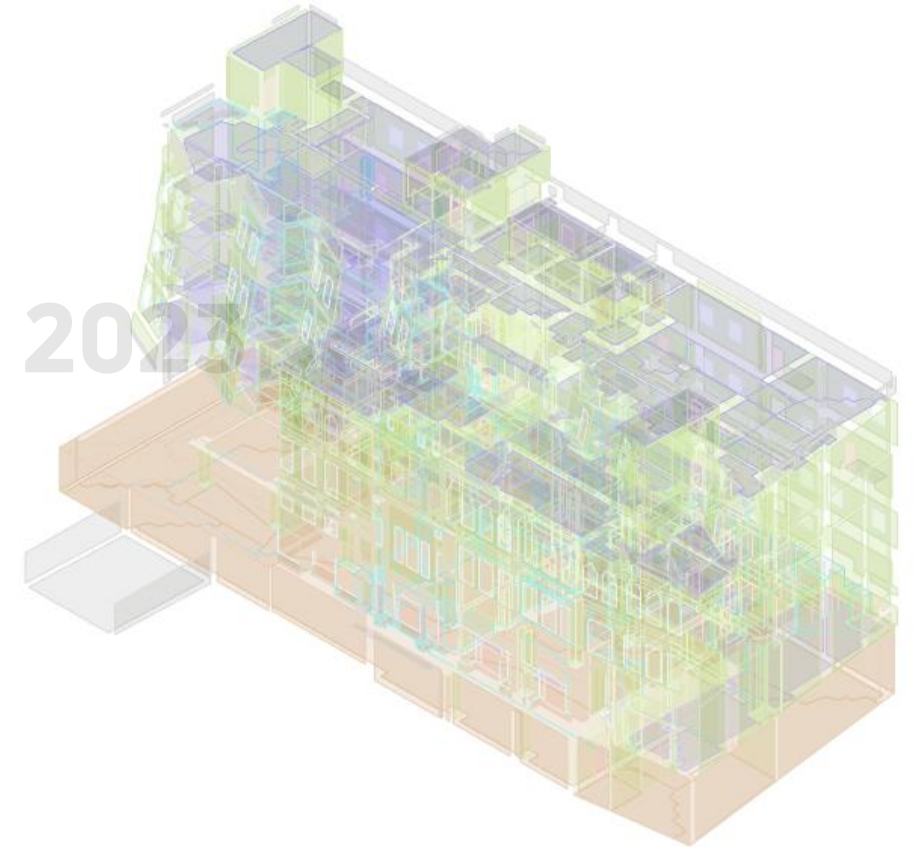
The Revit Energy Analytical Model

What is it, and how does it work?

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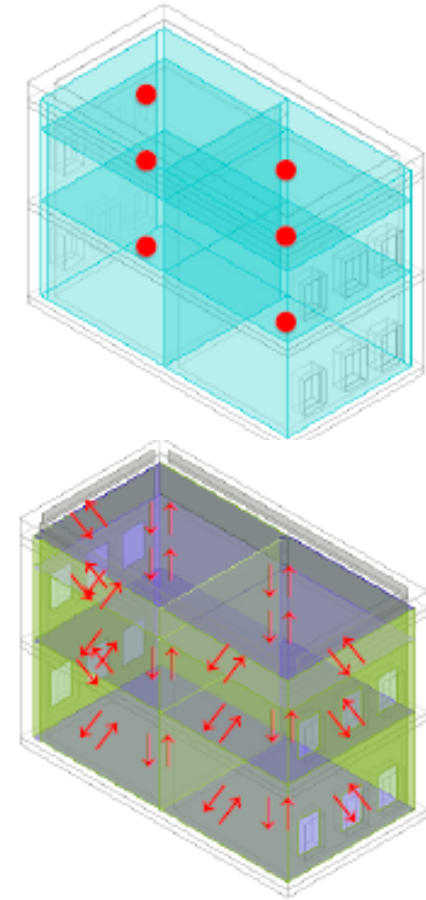
What is the EAM, and why do we use it...?

- Abstraction of a building's overall form and layout into a computational network.
- This network captures all the key paths and processes of heat transfer throughout the building.
- The EAM used for energy simulation engines DOE 2.2 and EnergyPlus, and powers **Energy Optimization** and **Systems Analysis** for Revit, as well as tools such as FenestraPro.
- Made up of two components – **Analytical Spaces** and **Analytical Surfaces**.



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- **Analytical Spaces** are discrete volumes of air that experience heat loss or gain. These heat changes are due to internal processes like occupancy, lighting, equipment, and HVAC, as well as heat exchange with other spaces and with the exterior environment.
- **Analytical Surfaces** are the paths of heat transfer to or from each space, including surfaces between interior spaces and the external environment. They contain the thermal and construction information for their associated building element.



Using the Revit Energy Analytical Model for Total Carbon Analysis from Concept to Detailed Design

The image shows the Autodesk Revit 2024 interface with the Energy Settings dialog box open. The dialog box is titled "Energy Settings" and contains a table of parameters and their values. A yellow box highlights the "Energy Analytical Model" section of the table. A tooltip for the "Energy Settings" button is also visible, explaining its function.

Energy Settings
Specifies parameters used to create the energy analytical model.
You can specify energy analytical model room and space options.
Press F1 for more help

Parameter	Value
Energy Analytical Model	
Mode	Use Conceptual Masses and Building Elements
Use Only Elements Visible In Current View	Use Building Elements
Ground Plane	Use Conceptual Masses and Building Elements
Project Phase	Use Rooms or Spaces
Analytical Space Resolution	1' 6"
Analytical Surface Resolution	1' 0"
Perimeter Zone Depth	15' 0"
Perimeter Zone Division	<input checked="" type="checkbox"/>
Average Vertical Void Height Threshold	6' 0"
Horizontal Void/Chase Area Threshold	1.00 SF
Reports Folder Path	.\<ProjectName>_Reports
Advanced	
Other Options	Edit...
Identity Data	
Design Option	Main Model

[How do these settings affect energy analysis?](#)

OK Cancel

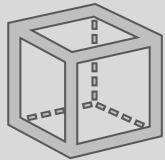
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Conceptual Masses

Use for Conceptual Massing only.

Retired.



Building Elements

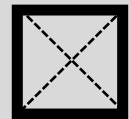
Use this with a Detailed Model elements only.

Legacy.



Conceptual Masses and Building Elements

Default mode, and preferred method.
Use when the model contains Conceptual Massing, Building Elements, or both.
Higher speed, lower precision.

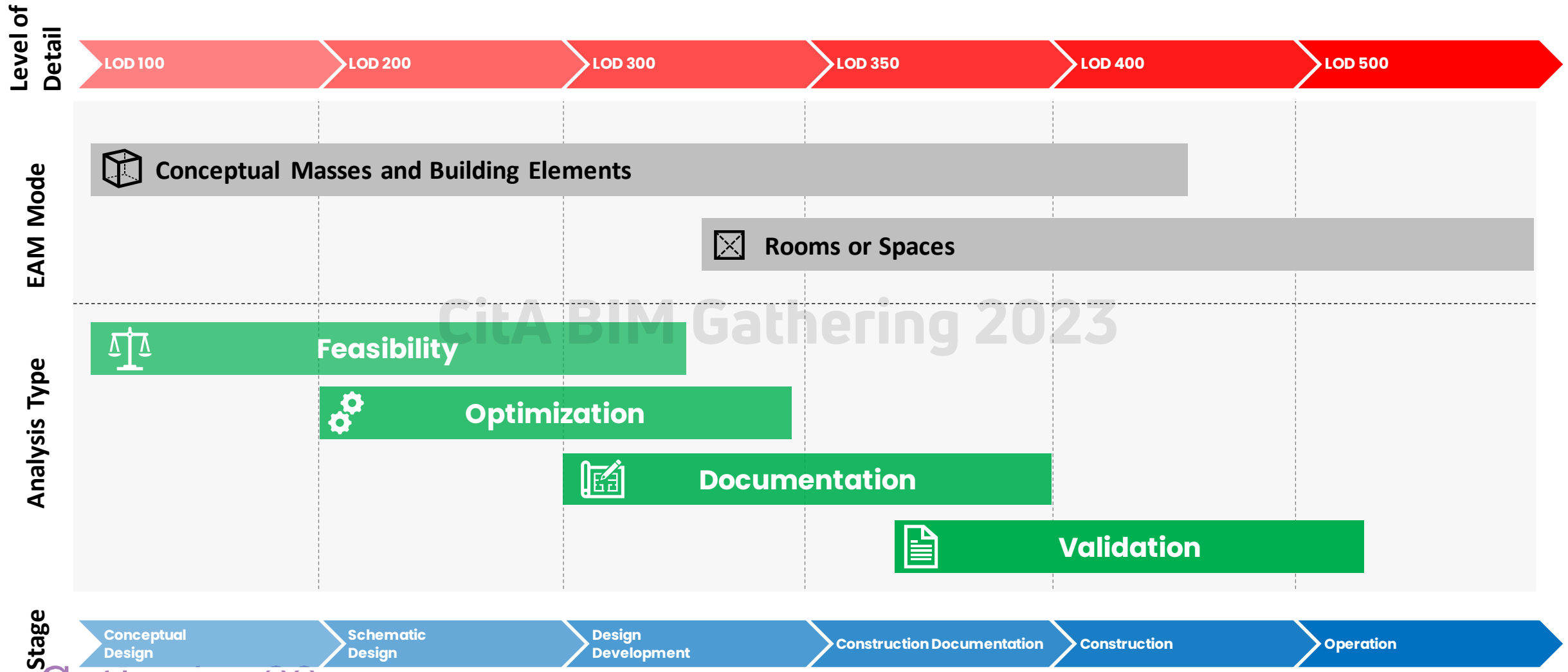


Rooms or Spaces

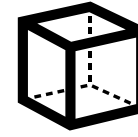
Use when the model contains Rooms or Spaces and is a more detailed model.

Lower speed, higher precision.

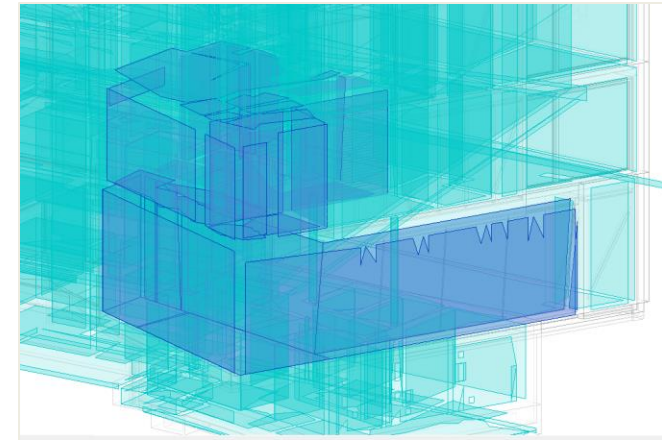
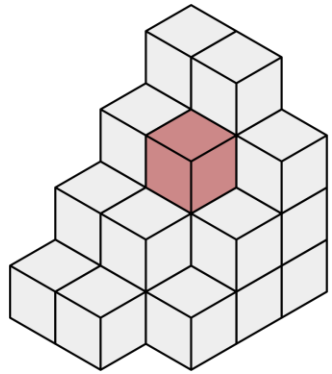
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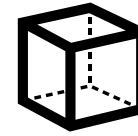


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- **Analytical Spaces** and **Surfaces** created from Room Bounding elements, using 'Voxel' method.
 - Three-dimensional grid to identify volumes, including external surfaces.
 - Can account for 'imperfect' Revit models – e.g., gaps / openings, using resolution settings.





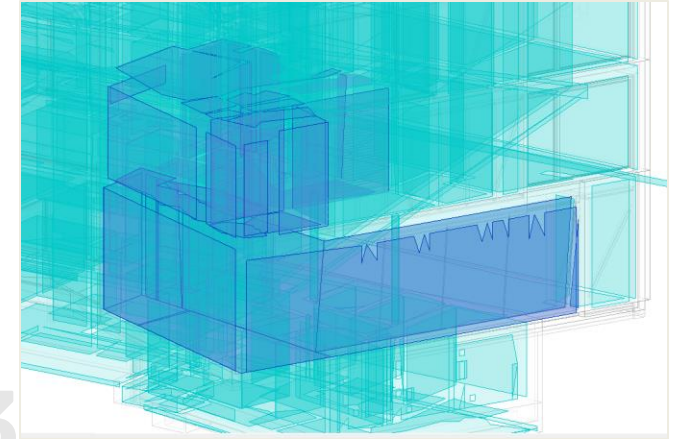
- **Analytical Spaces and Surfaces** created from Room Bounding elements, using 'Voxel' method.
 - Three-dimensional grid to identify volumes, including external surfaces.
 - Can account for 'imperfect' Revit models – e.g., gaps / openings, using resolution settings.

Pros

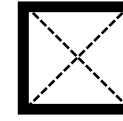
- More robust and accurate method and can deal with 'imperfect' models.
- Can deal with masses and elements, so can be used at any stage.

Cons

- More assumptions made regarding analytical information of spaces.
- Potentially lower precision, dependent on model.



Using the Revit Energy Analytical Model for Total Carbon Analysis from Concept to Detailed Design



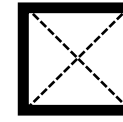
Mode:
Rooms or Spaces

Analytical Spaces created from Revit '**Rooms**' or '**Spaces**' – areas based on floor level wall elements extruded to give height.

- **Rooms** – No analytical data or properties.

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Mode:
Rooms or Spaces

Analytical Spaces created from Revit '**Rooms**' or '**Spaces**' – areas based on floor level wall elements extruded to give height.

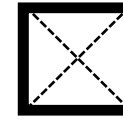
- **Rooms** – No analytical data or properties.

The screenshot displays the Revit interface with a floor plan of a residential unit. On the left, the Properties panel is open for a Room (R) on level L1. The panel shows the following details:

- Rooms (1)**: Edit Type
- Constraints**: Level: L1, Upper Limit: L2, Limit Offset: -1' 10 3/4", Base Offset: 0' 0"
- Dimensions**: Area: 276.62 SF, Perimeter: 67' 11 145/256", Unbounded Height: 9' 1 1/4", Volume: Not Computed, Computation Height: 0' 0"
- Identity Data**: Number: 104-B, Name: Living / Kitchen

The floor plan shows a symmetrical layout with two units, 103 and 104. Unit 103 includes Bedroom 1 (103-C), Bedroom 2 (103-D), Bath 1 (103-E), Bath 2 (103-F), Mech (103-H), Hallway (103-A), and Closet (103-G). Unit 104 includes Bedroom 1 (104-C), Bedroom 2 (104-D), Bath 1 (104-E), Bath 2 (104-F), Mech (104-H), Hallway (104-A), and Closet (104-G). A large Living / Kitchen area (104-B) is highlighted in blue on the right side of the plan. Dimensions of 7'-6" and 1'-6" are indicated on the plan.

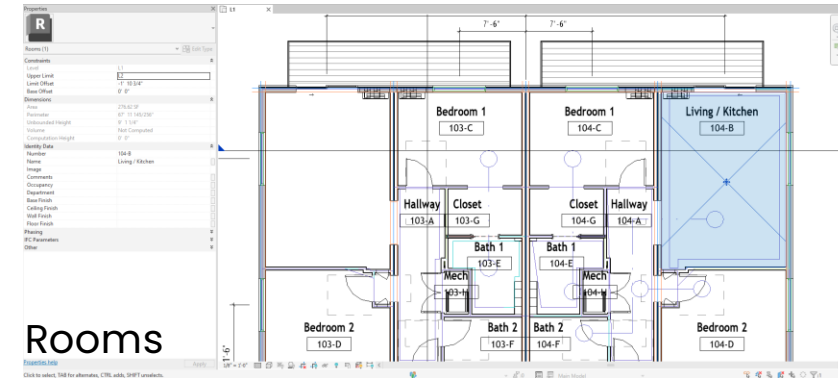
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Mode:
Rooms or Spaces

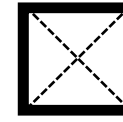
Analytical Spaces created from Revit '**Rooms**' or '**Spaces**' – areas based on floor level wall elements extruded to give height.

- Rooms – No analytical data or properties.
- **Spaces** – Contains analytical information.



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Using the Revit Energy Analytical Model for Total Carbon Analysis from Concept to Detailed Design



Mode:
Rooms or Spaces

Analytical Spaces created from Revit '**Rooms**' or '**Spaces**' – areas based on floor level wall elements extruded to give height.

- Rooms – No analytical data or properties.
- **Spaces** – Contains analytical information.

Properties

R

Spaces (1) Edit Type

Constraints

Level	L1
Upper Limit	L1
Limit Offset	8' 0"
Base Offset	0' 0"

Electrical - Lighting

Average Estimated Illumination	0.00 lx
Room Cavity Ratio	0.000000
Lighting Calculation Workplane	2' 6"
Lighting Calculation Luminaire Plane	Not Computed
Ceiling Reflectance	75.0000%
Wall Reflectance	50.0000%
Floor Reflectance	20.0000%

Electrical - Loads

Design HVAC Load per area	0.00 W/ft ²
Design Other Load per area	0.00 W/ft ²

Dimensions

Area	276.62 SF
Perimeter	67' 11 145/256"
Unbounded Height	8' 0"
Volume	Not Computed
Computation Height	0' 0"

Mechanical - Flow

Specified Supply Airflow	0.00 CFM
Calculated Supply Airflow	Not Computed
Actual Supply Airflow	0.00 CFM
Return Airflow	Specified
Specified Return Airflow	0.00 CFM
Actual Return Airflow	0.00 CFM
Specified Exhaust Airflow	0.00 CFM
Actual Exhaust Airflow	0.00 CFM
Outdoor Airflow	19.81 CFM

Identity Data

Number	1
Name	Space
Room Number	Unoccupied
Room Name	Unoccupied
Image	
Comments	

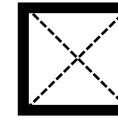
Properties help

Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

1/8" = 1'-0"

Main Model

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Mode:
Rooms or Spaces

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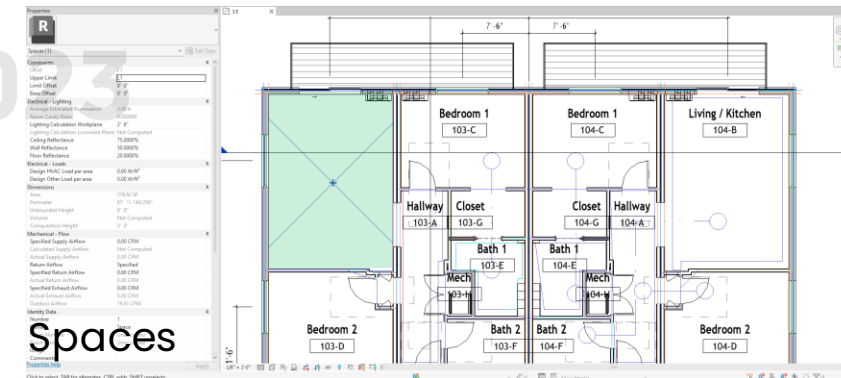
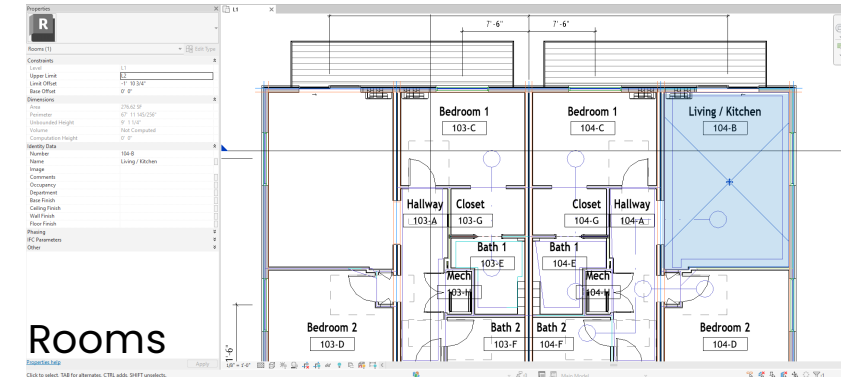
- Rooms – No analytical data or properties.
- Spaces – Contains some analytical information.

Pros

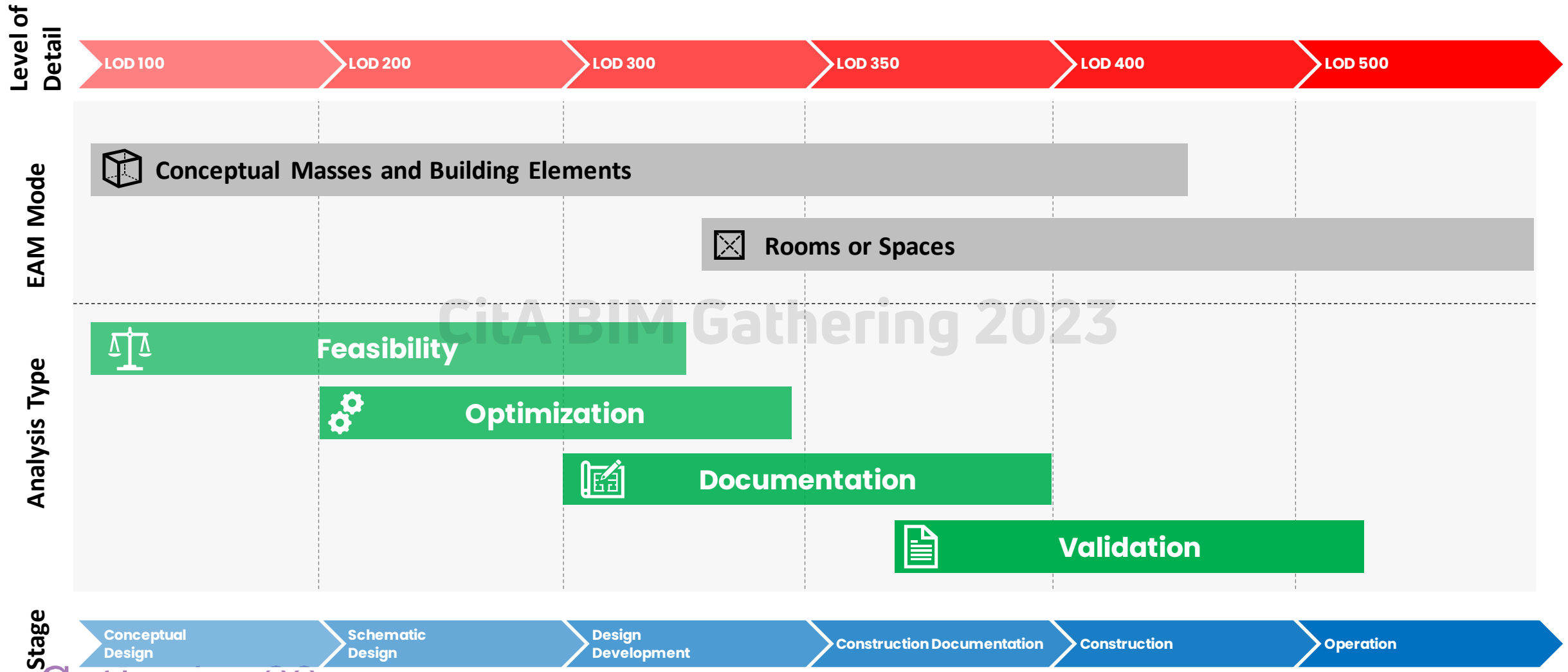
- Precise and detailed analytical information extracted from Revit elements.
- Can differentiate different spaces with different Loads, Lighting, Occupancy etc.

Cons

- Needs almost perfect geometry, so can often require huge manual input and resources to existing architectural model.
- Will not recognise 'irregular' rooms, spaces or voids.
- Either 'Rooms' or 'Spaces'... not both.



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Worked Examples

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Workflow 1

Conceptual Massing (Simple)

- Create an Energy Analytical Model from a simple conceptual mass.



Workflow 2

Conceptual Massing (from Detailed Elements)

- Link a detailed Architectural Model to EAM Template file.
- Create a conceptual mass of basic form.
- Create an Energy Analytical Model from the conceptual mass.



Workflow 3

Conceptual Massing and Building Elements

- Manipulate visibility settings to isolate the conceptual mass, and facades.
- Apply Walls By Face.
- Create an Energy Analytical Model from the conceptual mass and building elements.

Using the Revit Energy Analytical Model for Total Carbon Analysis from Concept to Detailed Design



Workflow 4

Conceptual Massing and Building Elements

- Manipulate visibility settings to isolate the building envelope.
- Create an Energy Analytical Model from the conceptual masses and building elements.



Workflow 5

Rooms and Spaces

- Manipulate visibility settings to isolate the building envelope and internal rooms / spaces.
- Create an Energy Analytical Model from the Rooms and Spaces.



Workflow 6

Conceptual Massing and Building Elements

- Identify material properties in building element families.
- Send for Total Carbon analysis in Next Gen Insight.

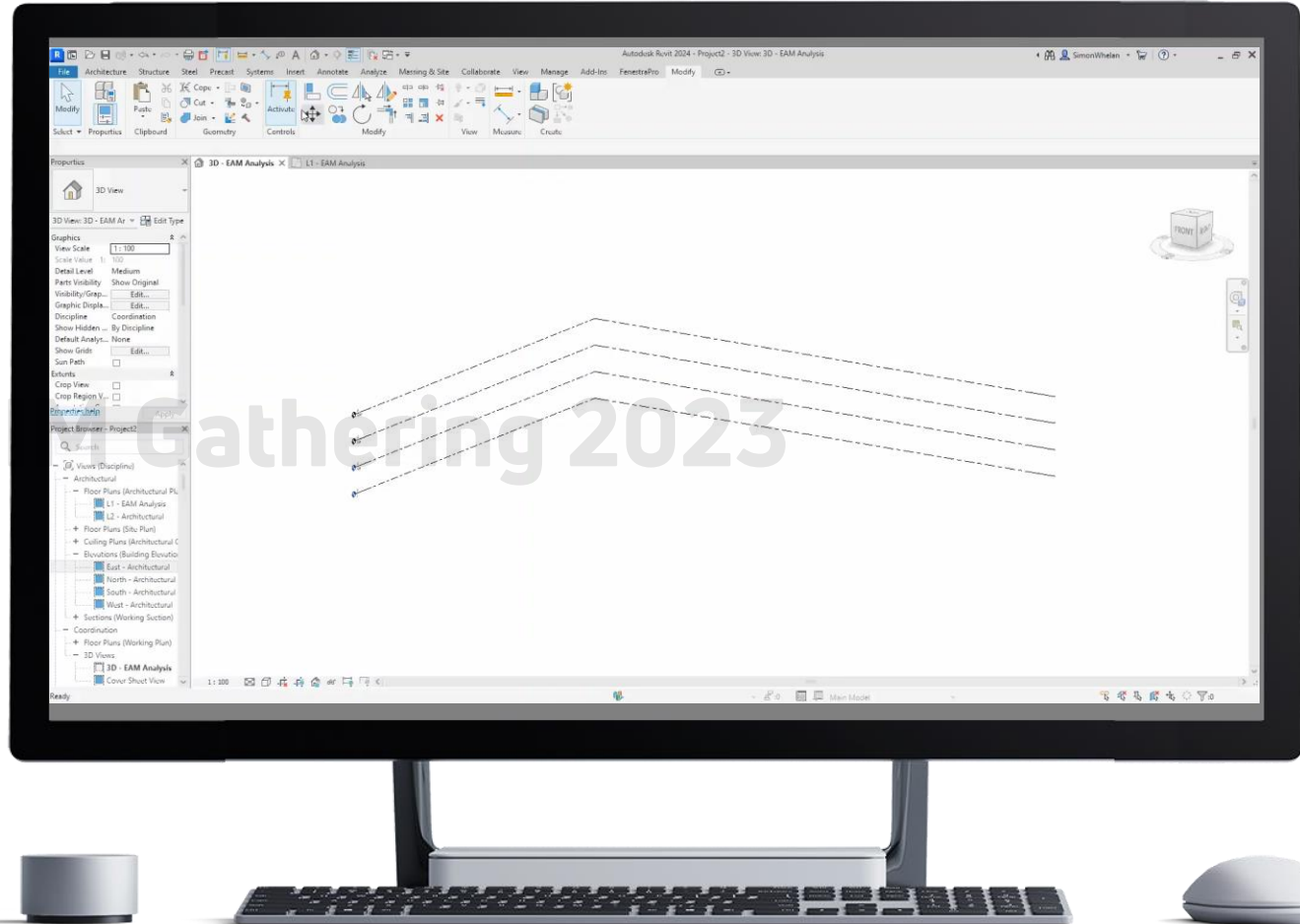
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Workflow 1

Conceptual Massing (Simple)

- Create an Energy Analytical Model from a simple conceptual mass.



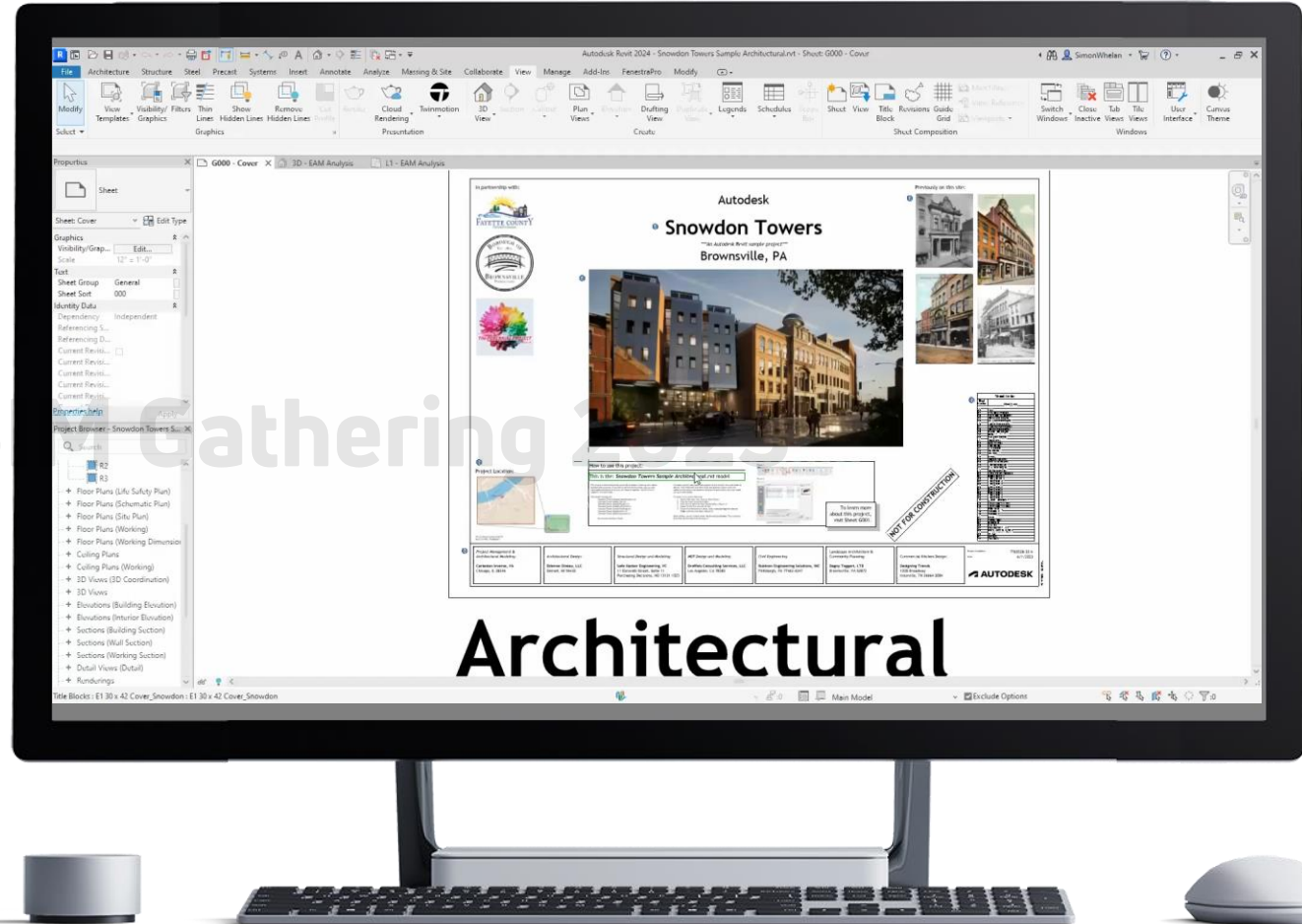
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Workflow 2

Conceptual Massing (Simple)

- Create an Energy Analytical Model from a simple conceptual mass.



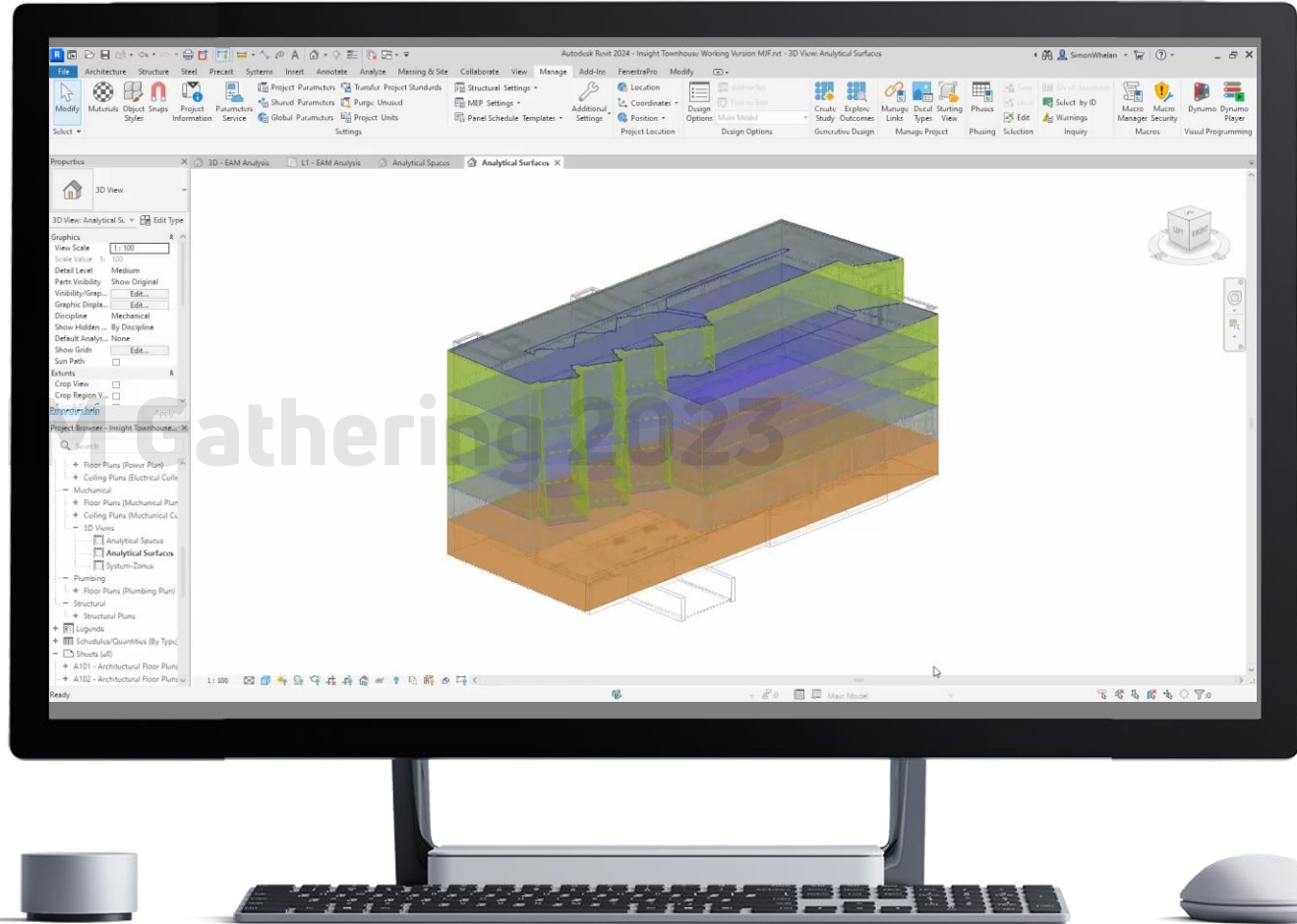
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Workflow 3

Conceptual Massing and Building Elements

- Manipulate visibility settings to isolate the conceptual mass, and facades.
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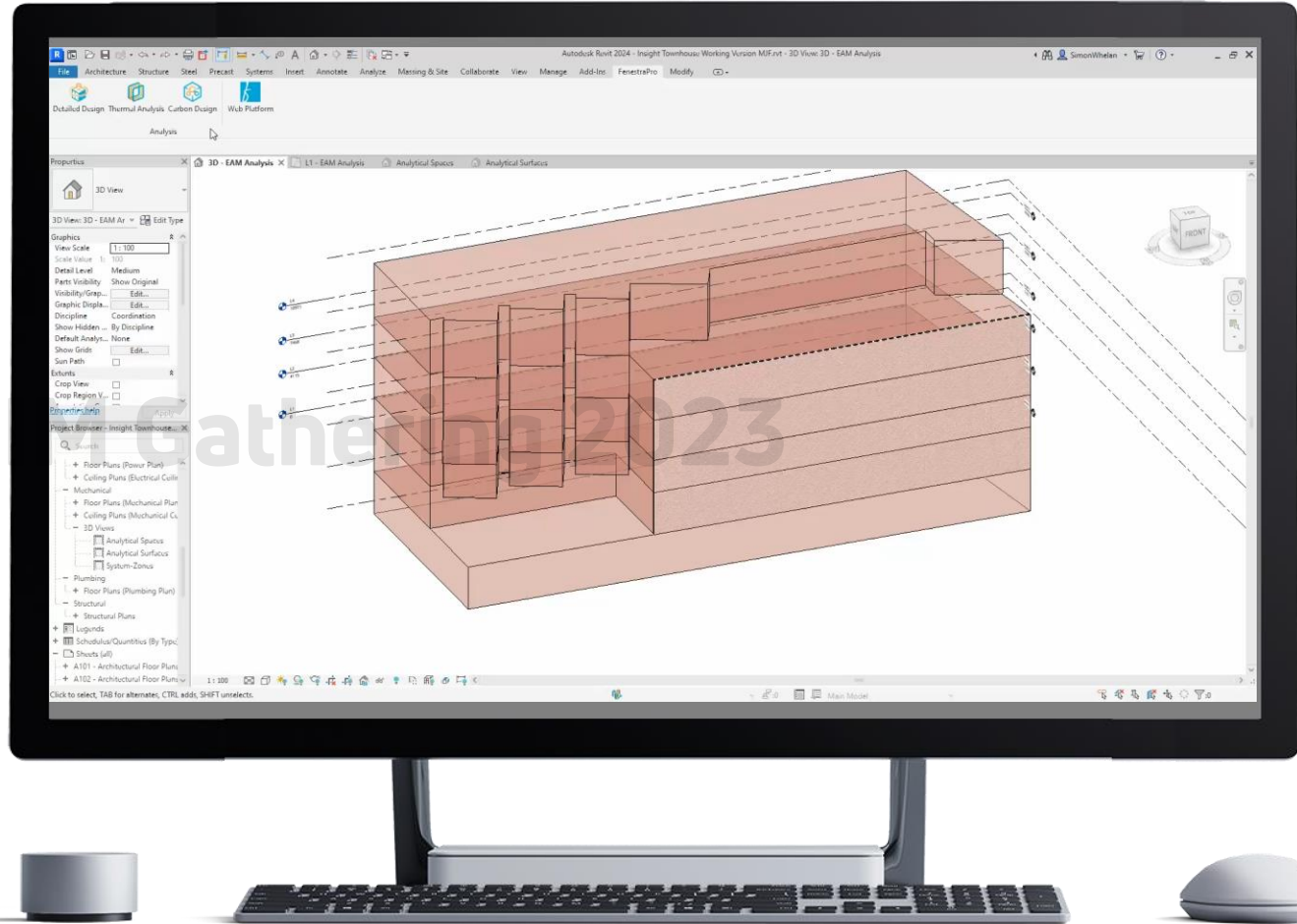
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Workflow 4

Conceptual Massing and Building Elements

- Manipulate visibility settings to isolate the building envelope.
- Create an Energy Analytical Model from the conceptual masses and building elements.



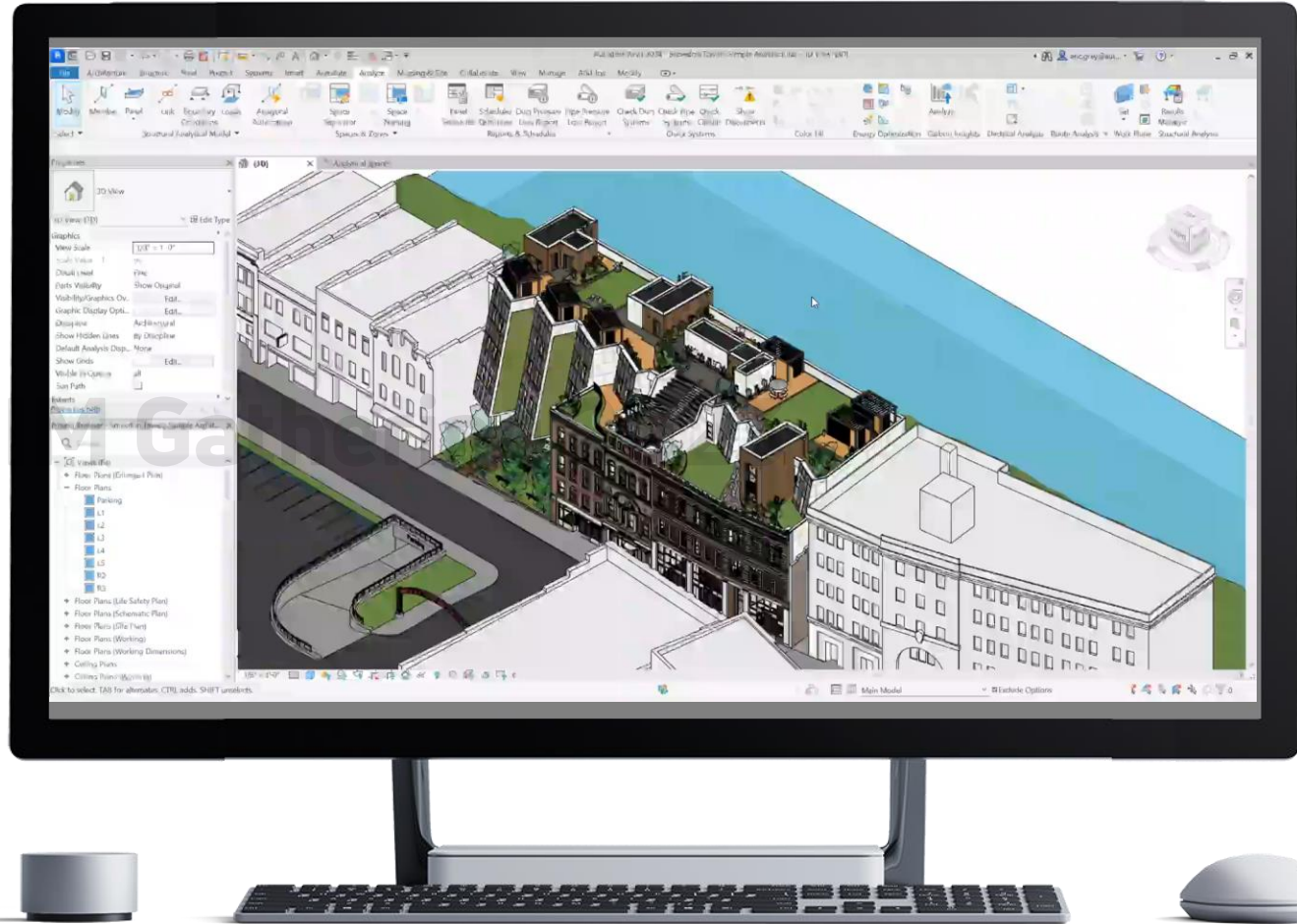
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Workflow 6

Conceptual Massing and Building Elements

- Identify material properties in building element families.
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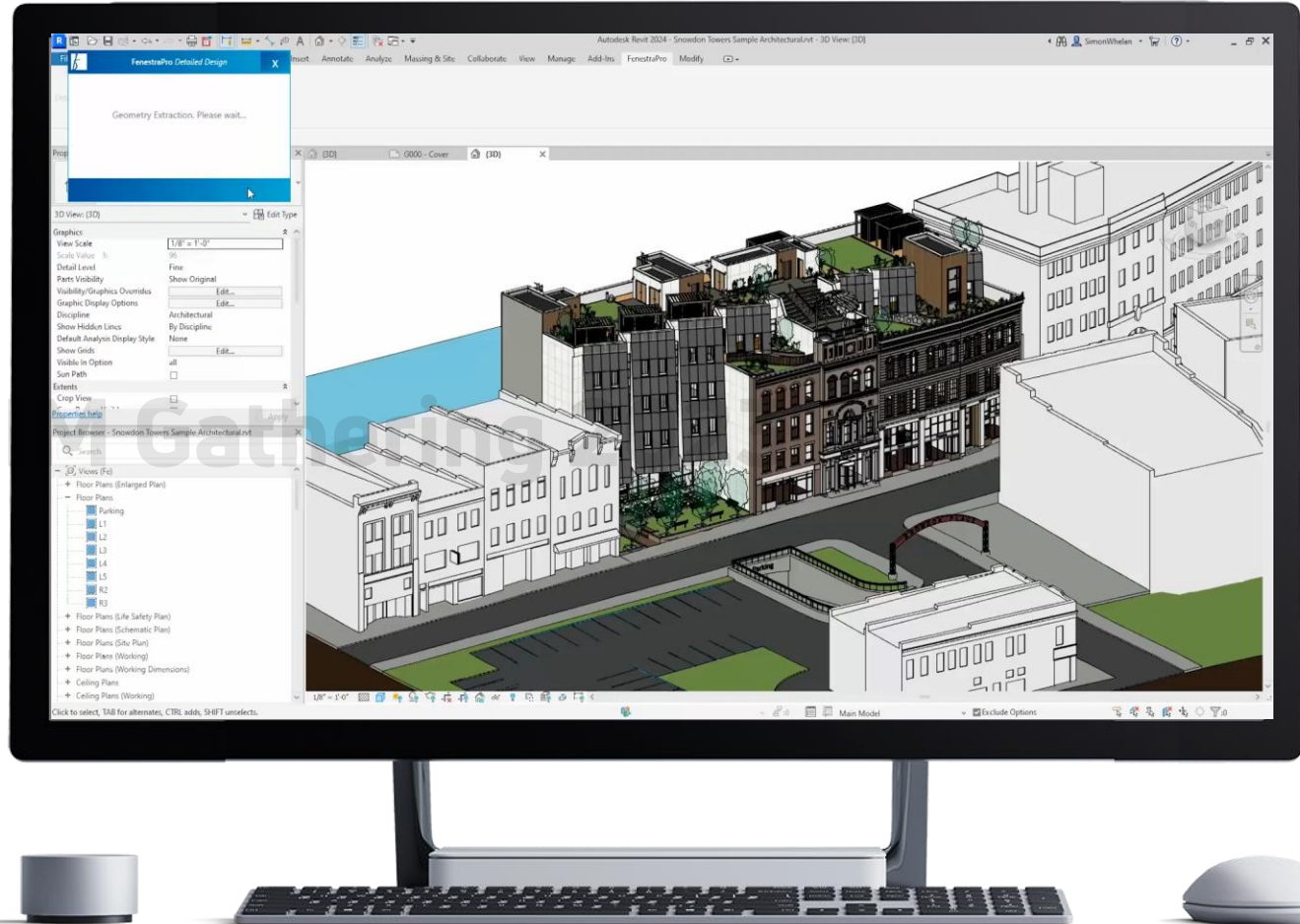


Advice on model issues

Assign missing performance properties

Visualise issues

Review warnings





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THANK YOU