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

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

Simon Whelan

Founder / COO of FenestraPro

- Façade Design Applications
- Autodesk Industry Partners and Development Partners

Architectural Technologist, with Masters in Advanced Energy & Environmental Systems

10+ Years as Director in Architectural Firm

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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.

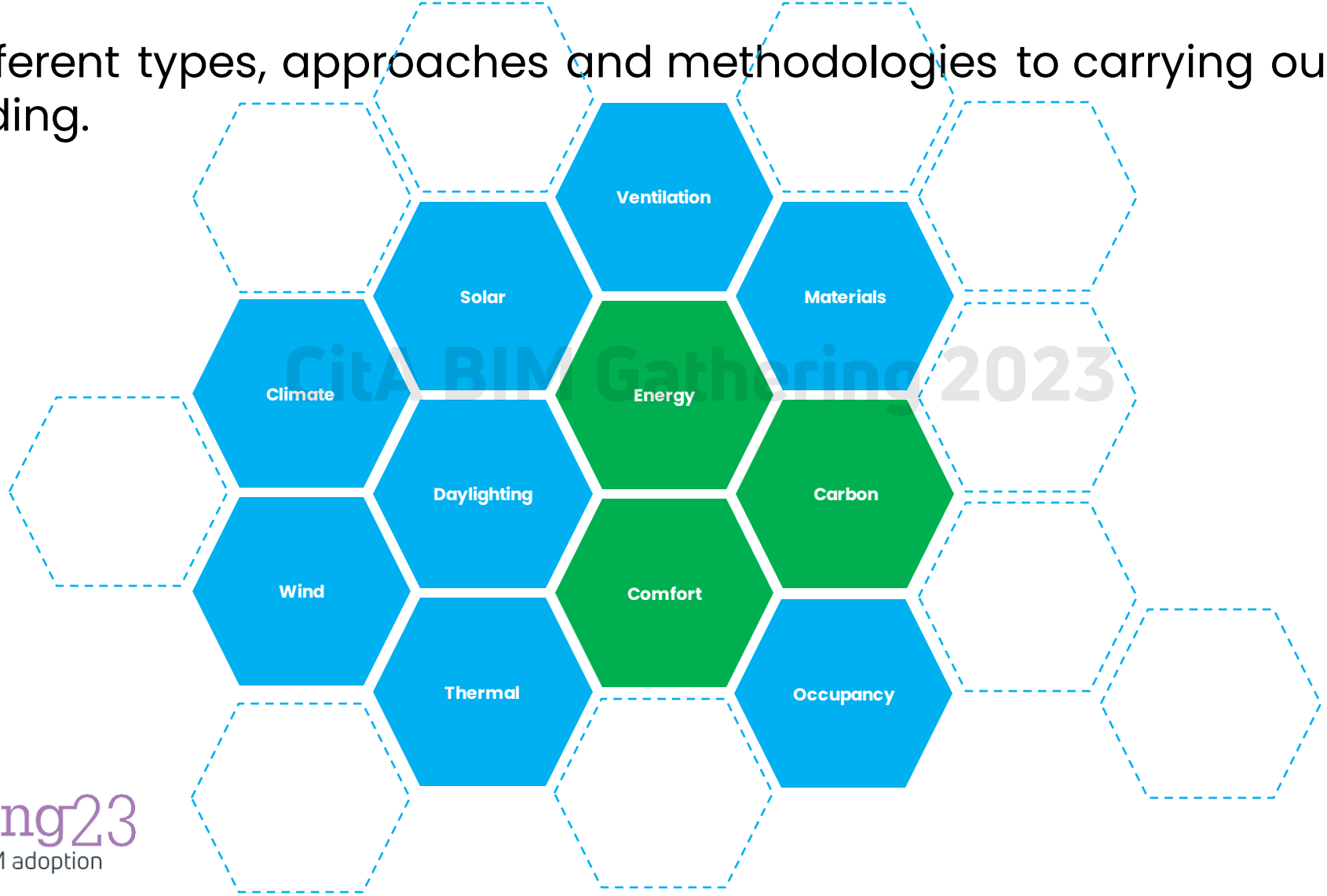
Hear about FenestraPro's experience with designers on overcoming key barriers, and adding value to what Revit offers today.

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

Building Energy Analysis

Is there ever a ‘right’ answer?

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



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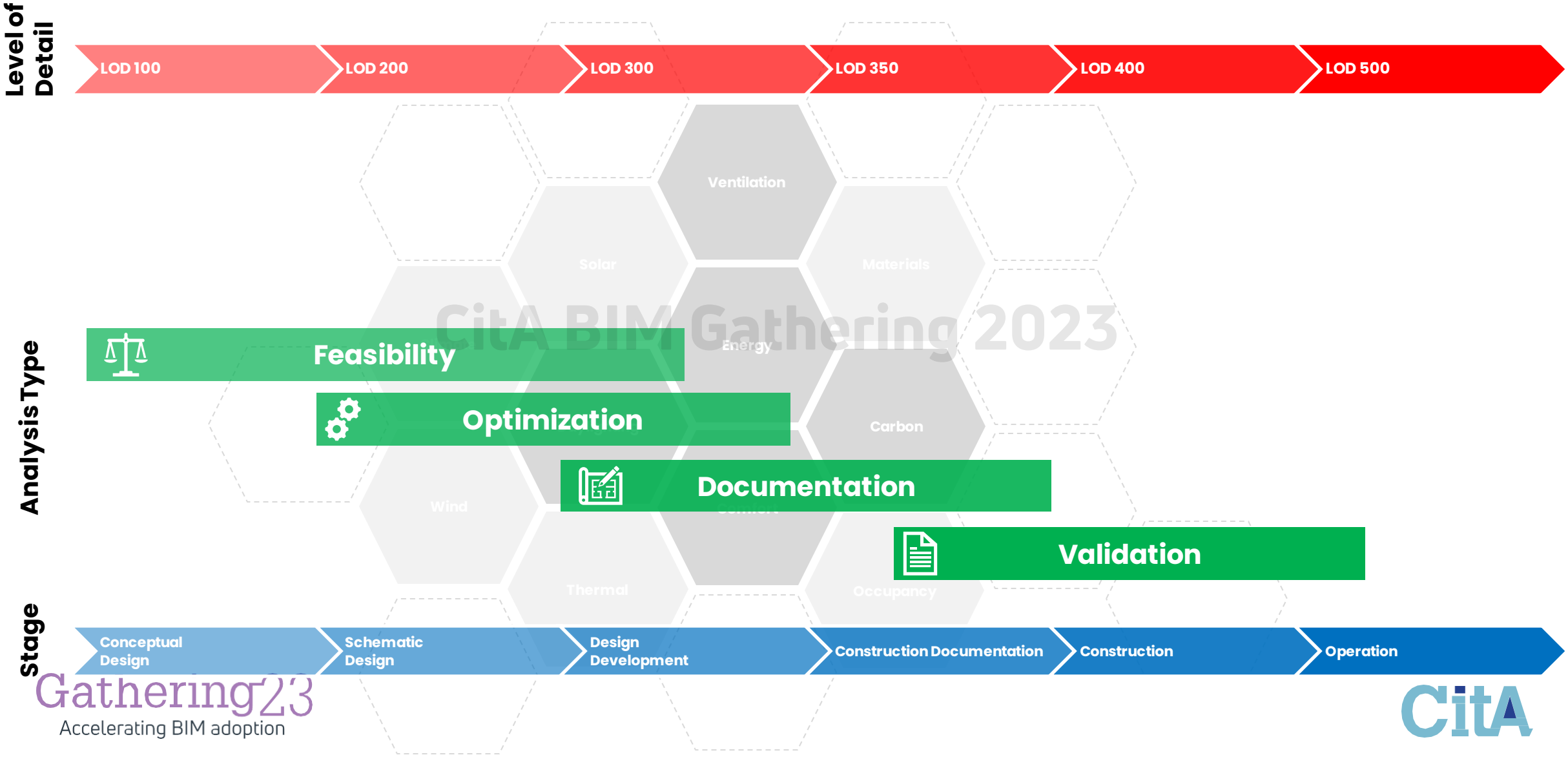

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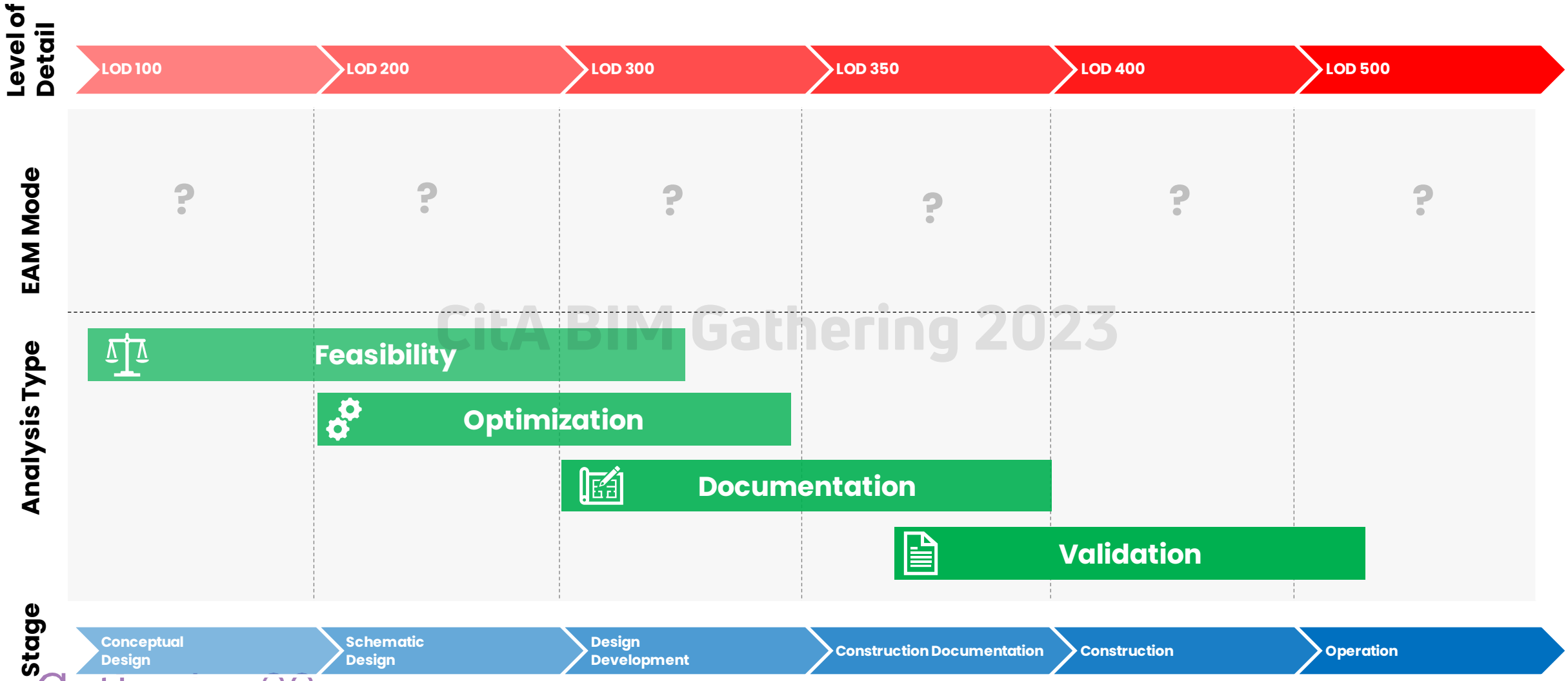

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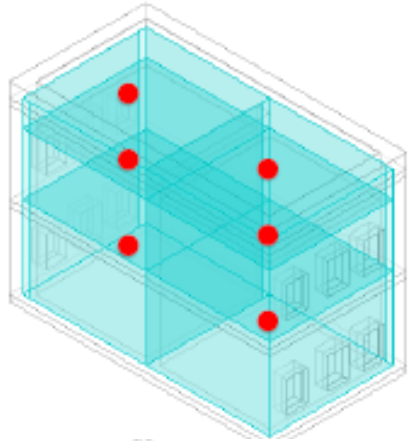
The Revit Energy Analytical Model

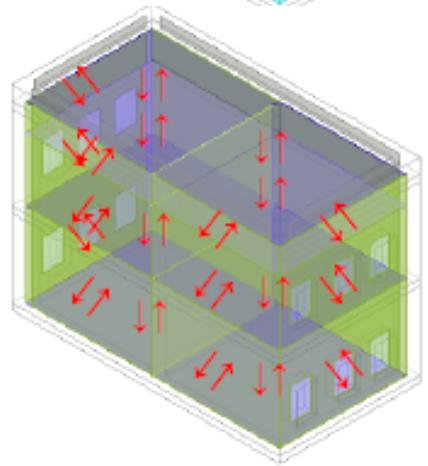
What is it, and how does it work?

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**.

- **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.





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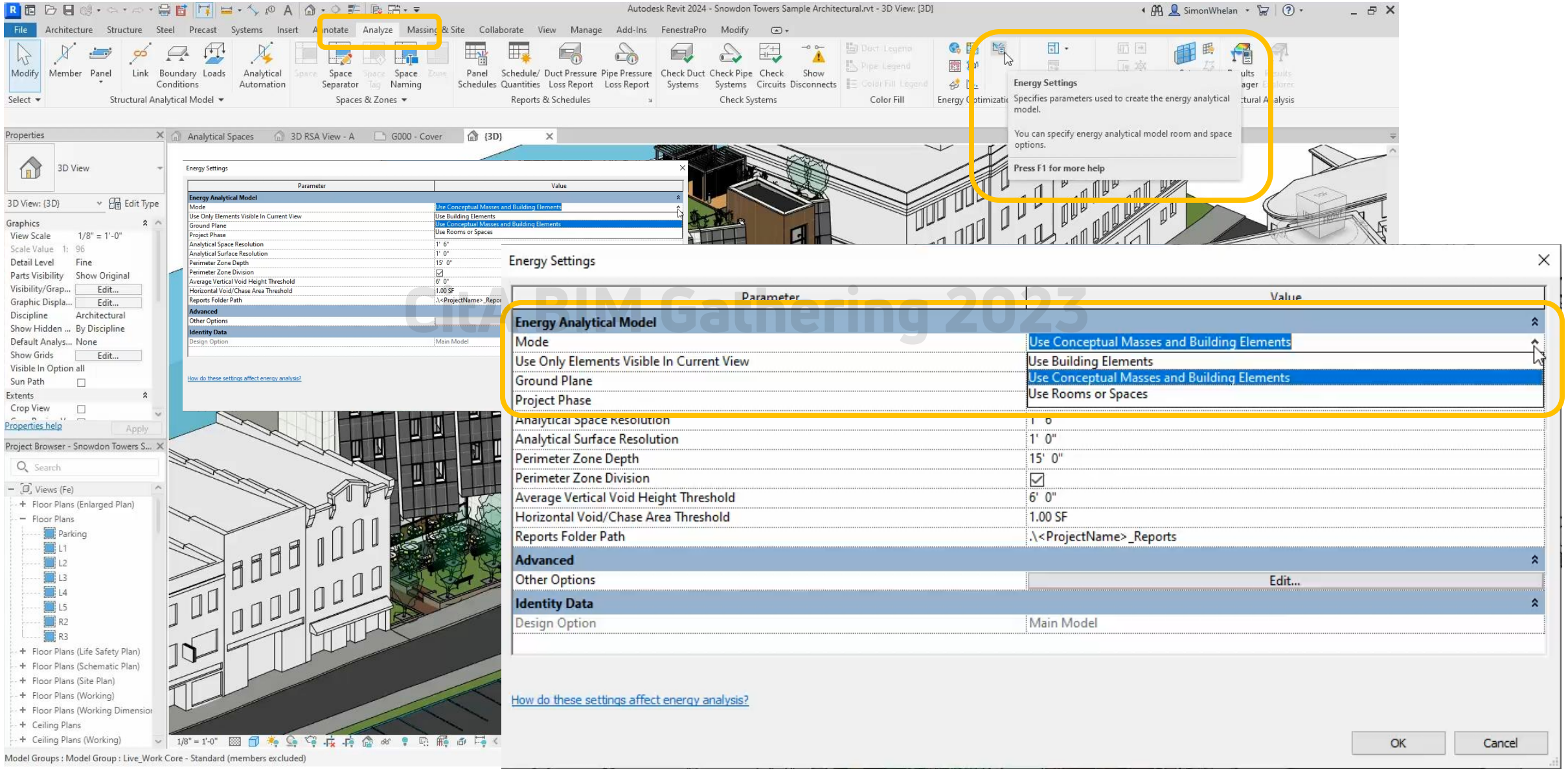

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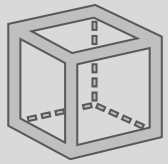
 Conceptual Masses	Use for Conceptual Massing only. **Retired.**
 Building Elements	Use this with a Detailed Model elements only. **Legacy.**
 **Conceptual Masses and Building Elements**	Default mode, and preferred method. Use when the model contains Conceptual Massing, Building Elements, or both. **Higher 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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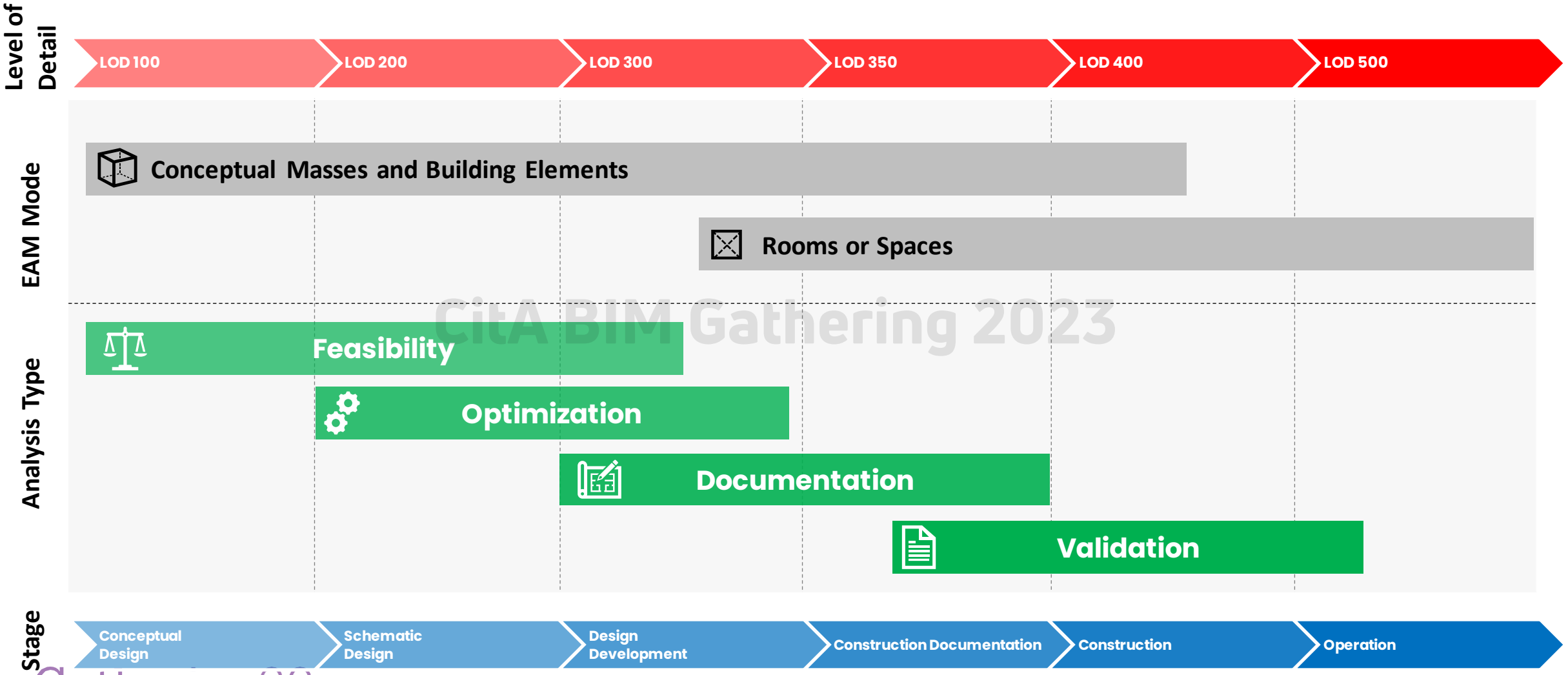

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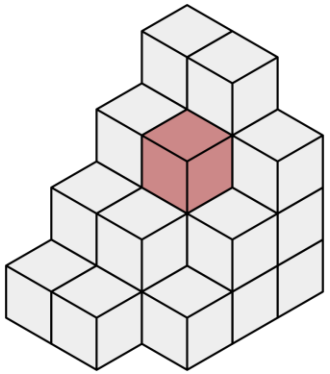
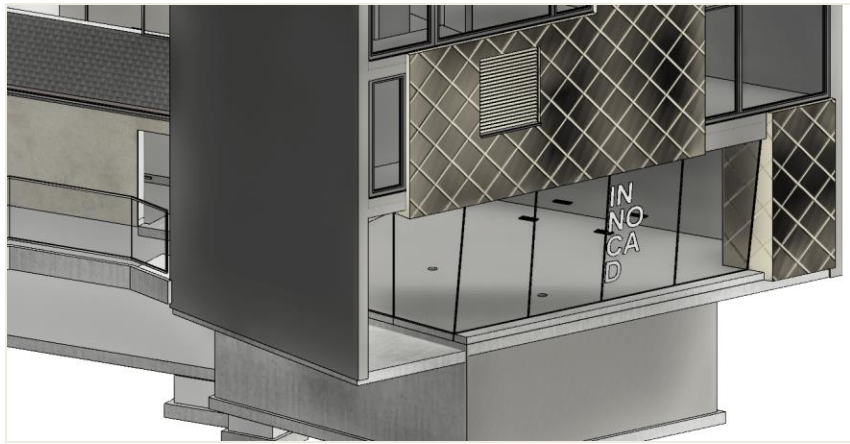
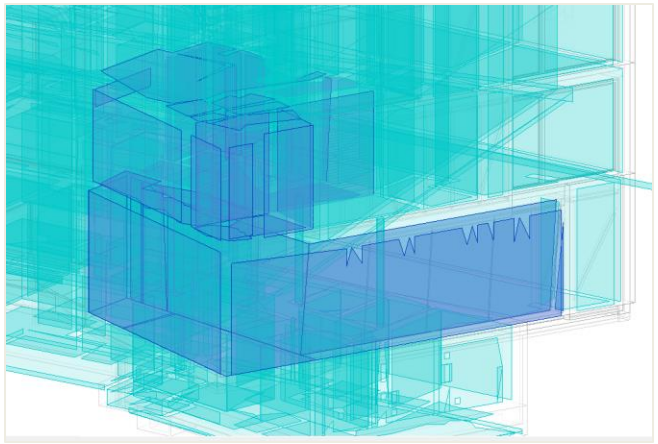
Mode:
Conceptual Masses and Building Elements

- **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.







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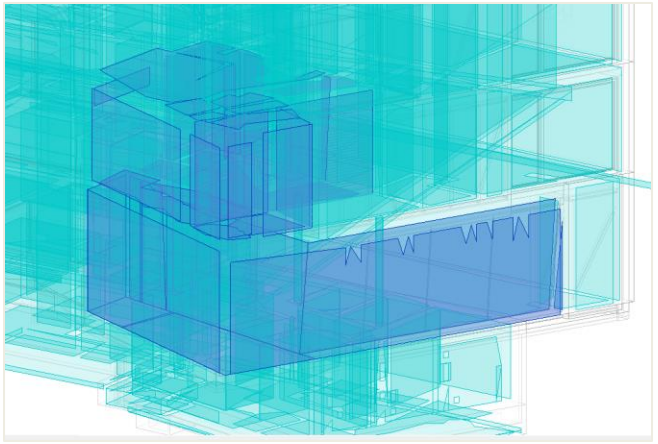
  - Three-dimensional grid to identify volumes, including external surfaces.
  - Can account for 'imperfect' Revit models – e.g., gaps / openings, using resolution settings.

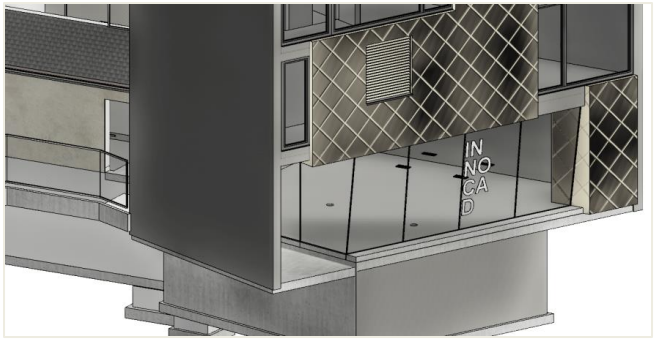
Pros

- 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.





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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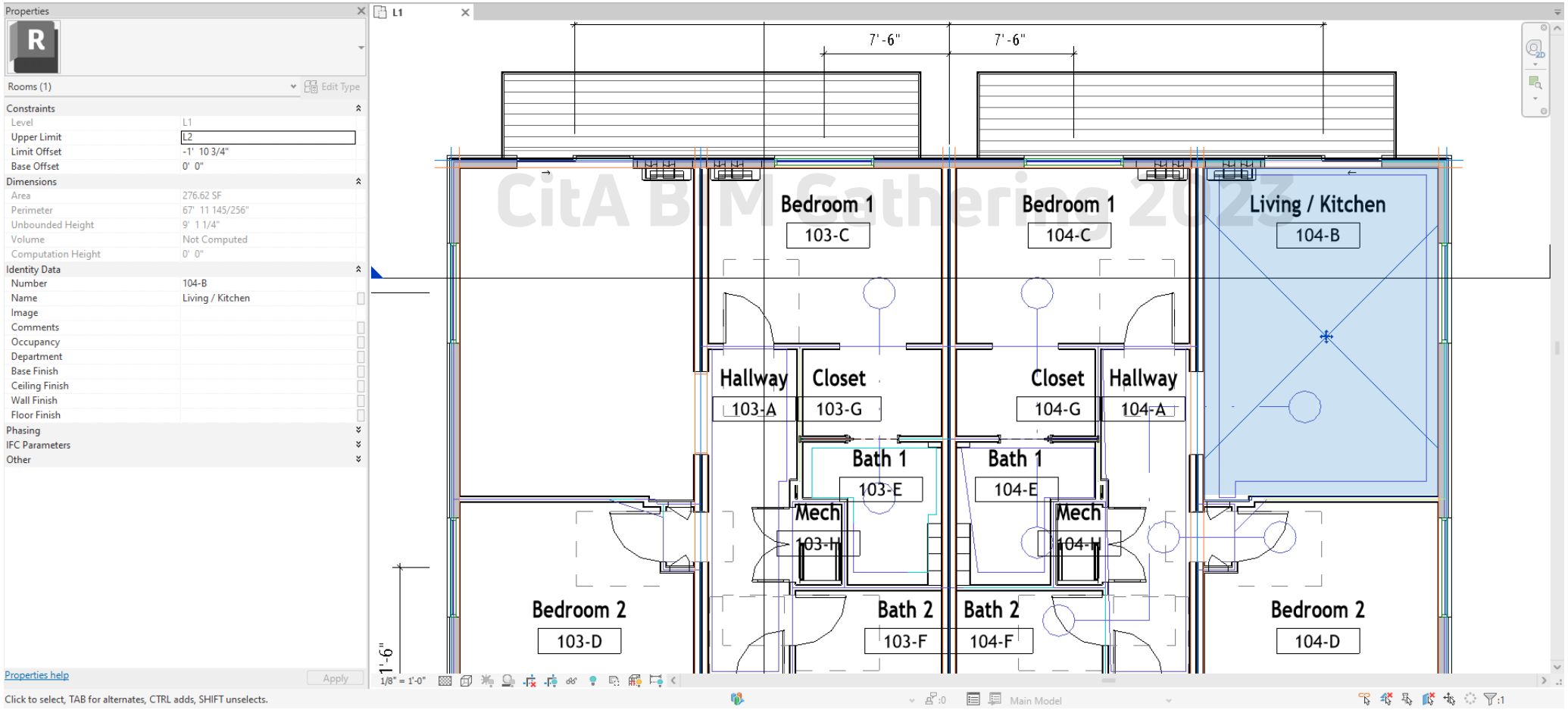

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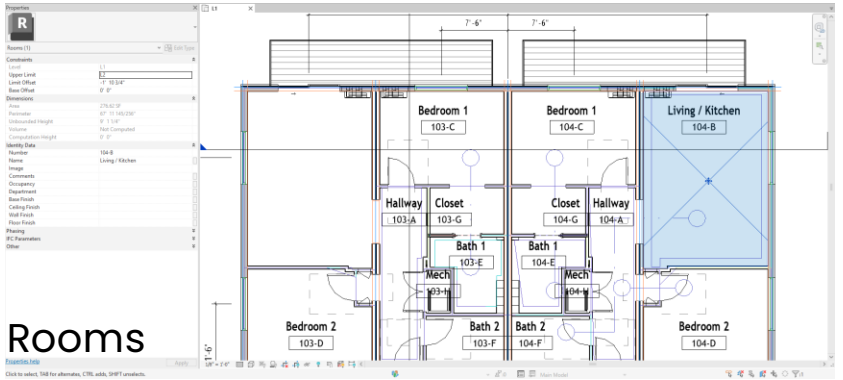
- Rooms – No analytical data or properties.
- **Spaces** – Contains analytical information.



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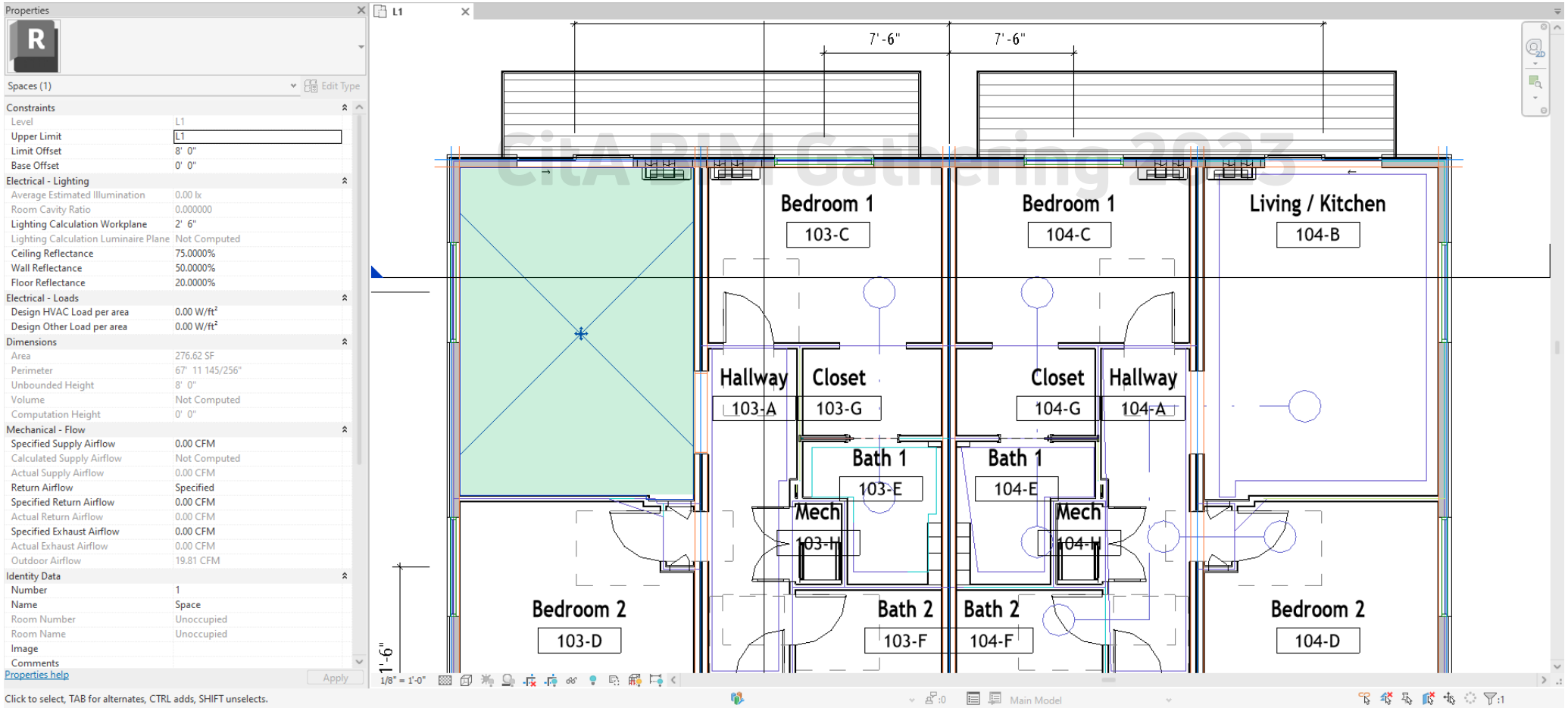

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Mode:
Rooms or Spaces

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

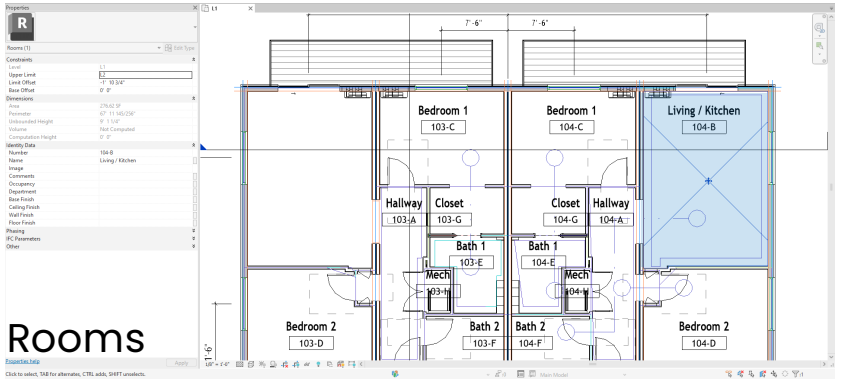
- Rooms – No analytical data or properties.
- Spaces – Contains some analytical information.

Pros

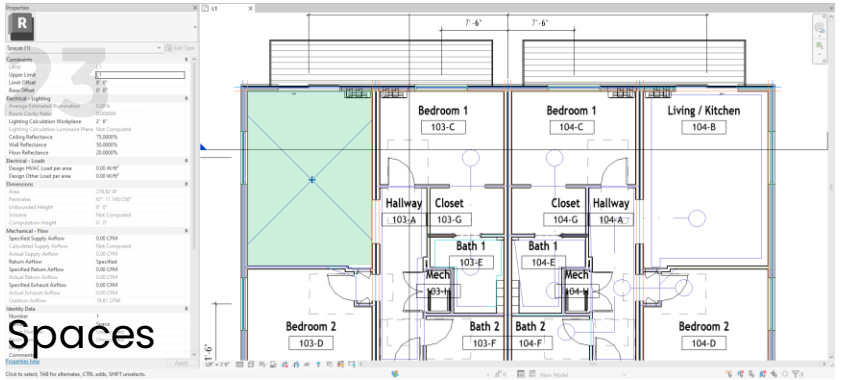
- Precise and detailed analytical information extracted from Revit elements.
- Can differentiate different spaces with different Loads, Lighting, Occupancy etc.

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.



Rooms



Spaces

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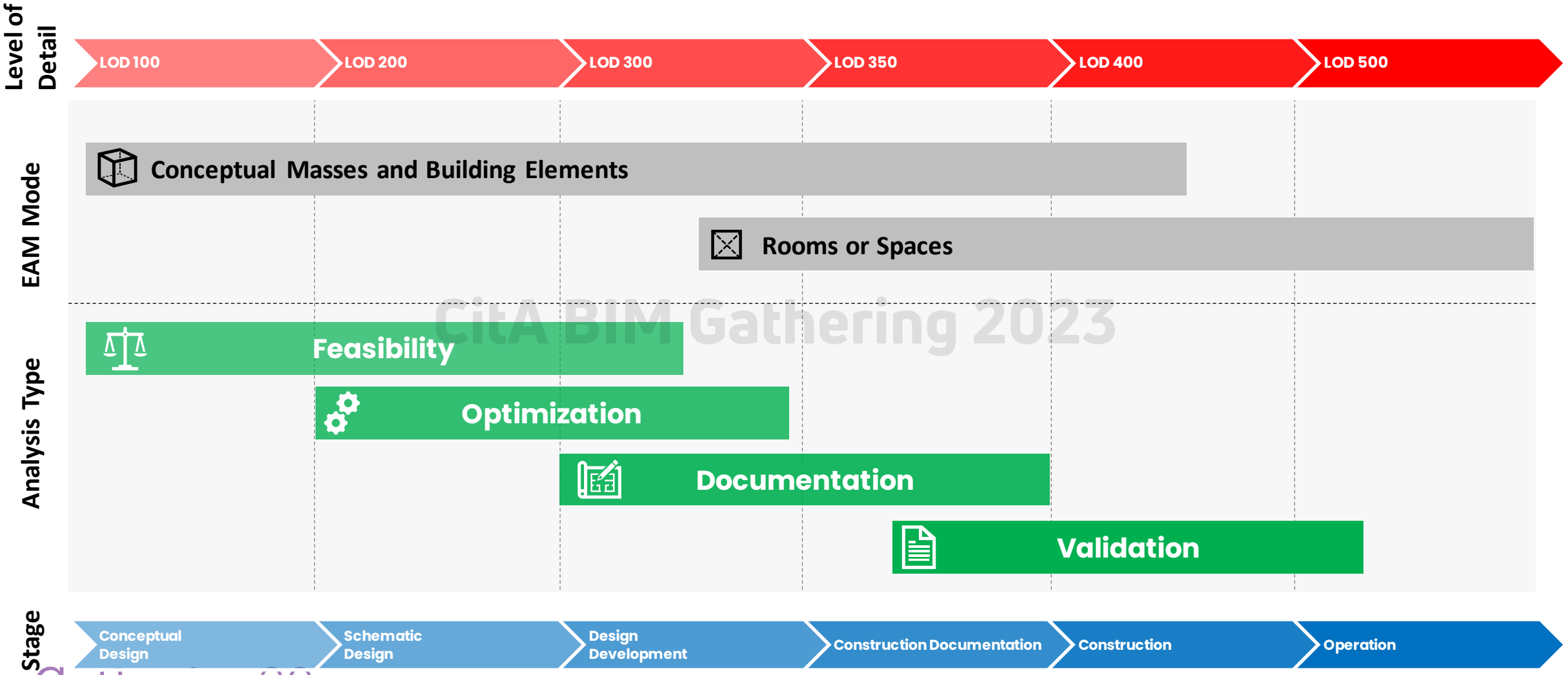

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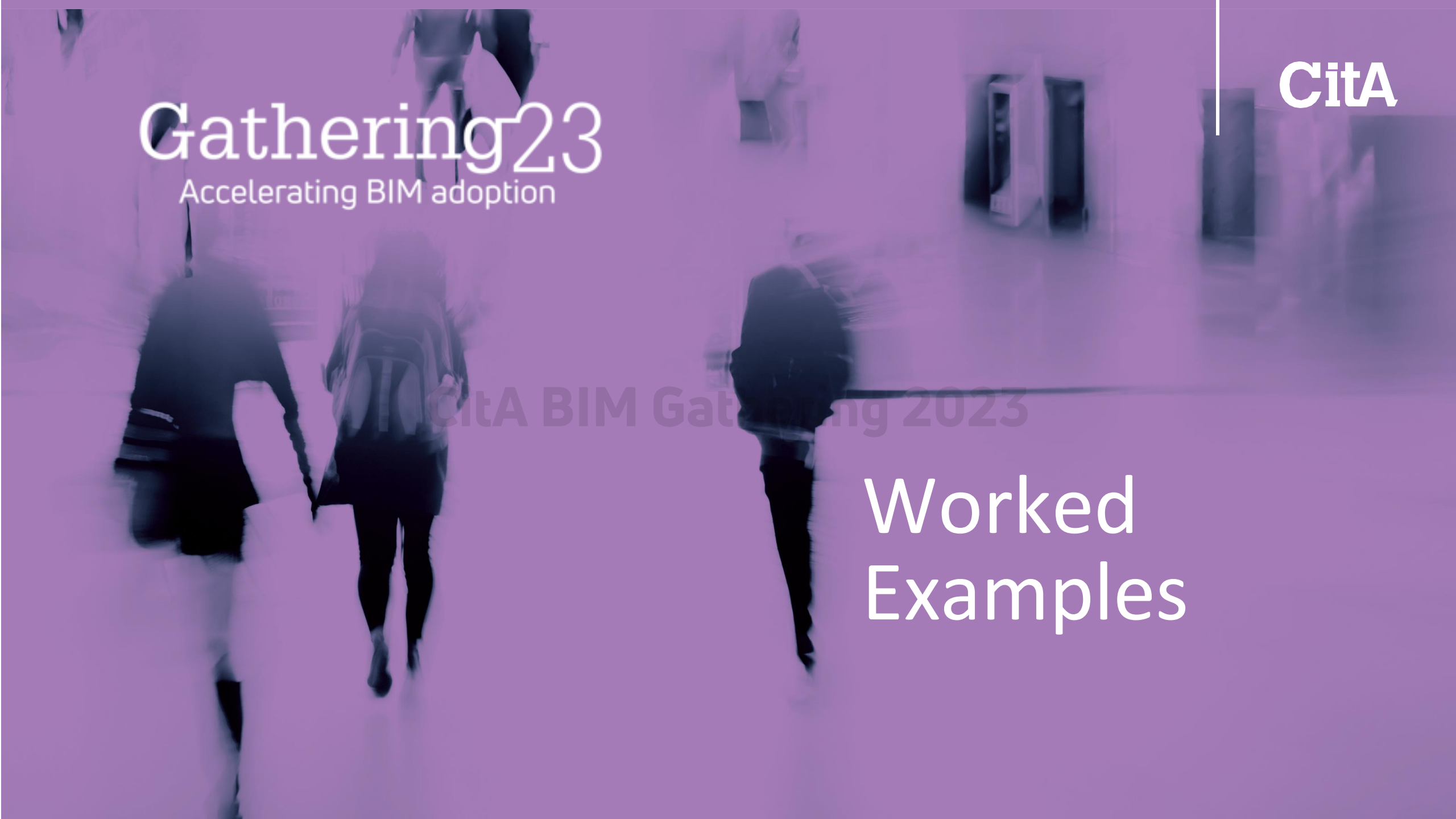

Worked Examples

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

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.

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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.

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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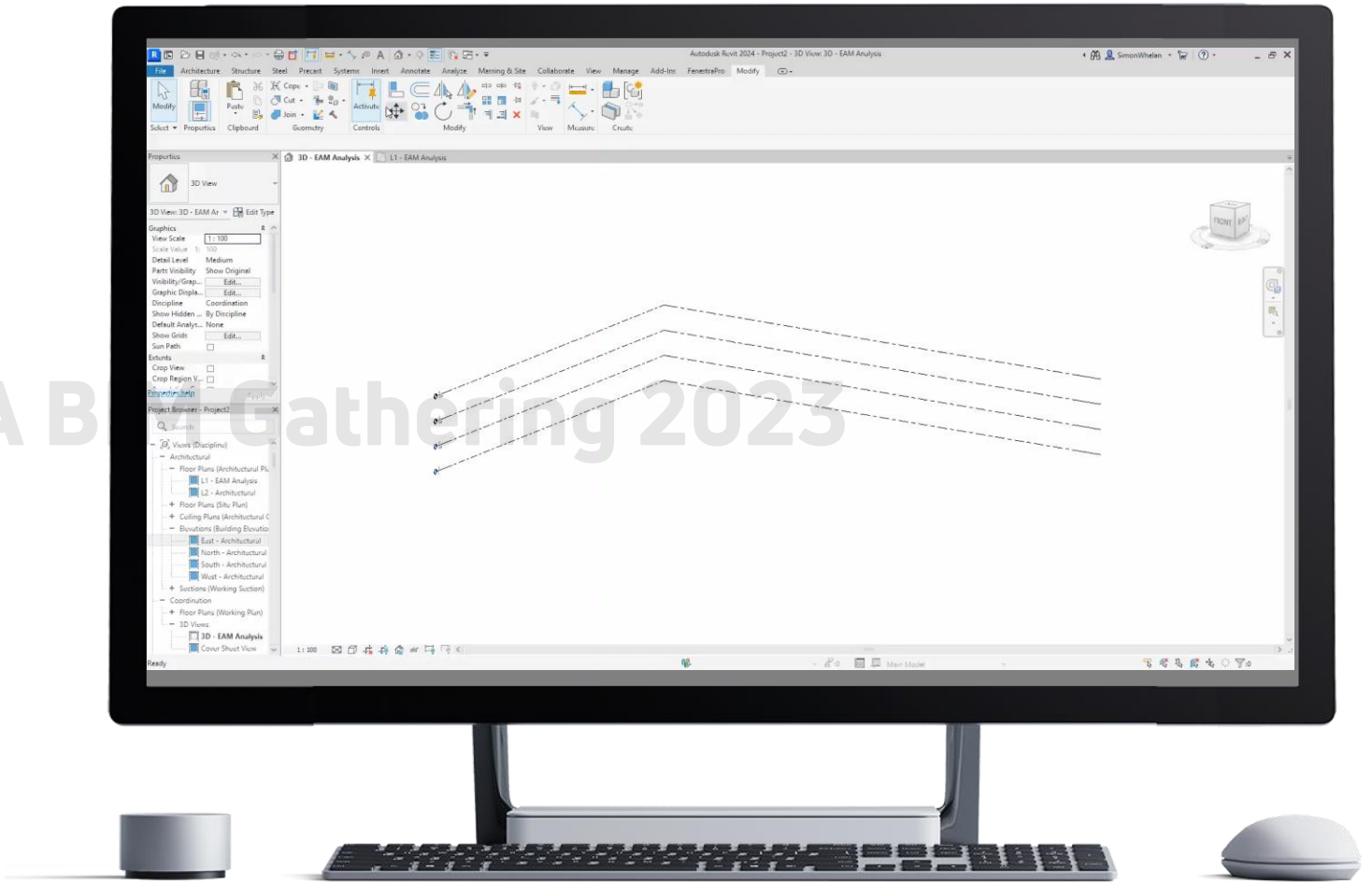
Workflow 1

Conceptual Massing (Simple)

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



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Workflow 2

Conceptual Massing (Simple)

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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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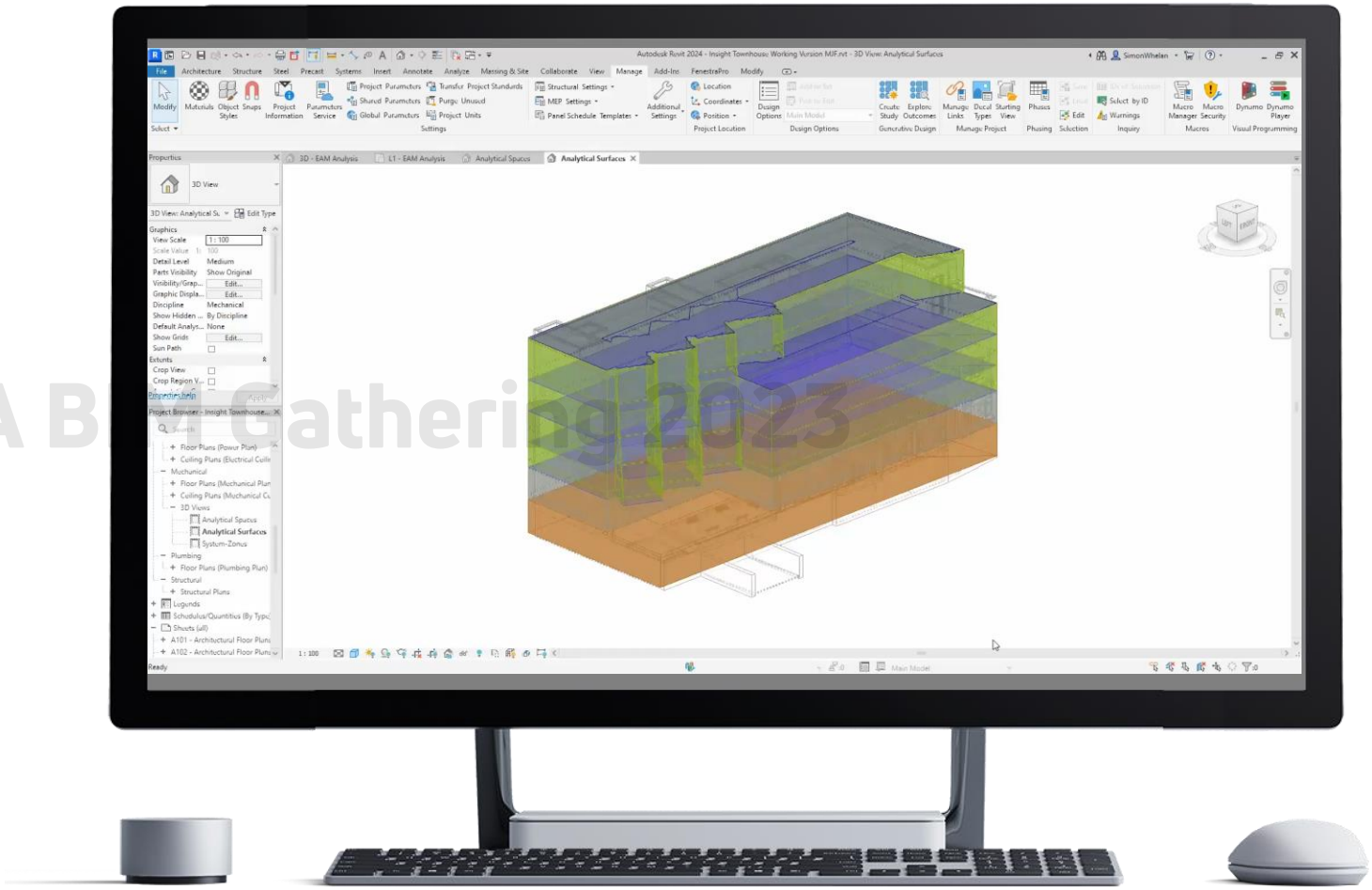

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Workflow 4

Conceptual Massing and Building Elements

- Manipulate visibility settings to isolate the building envelope.
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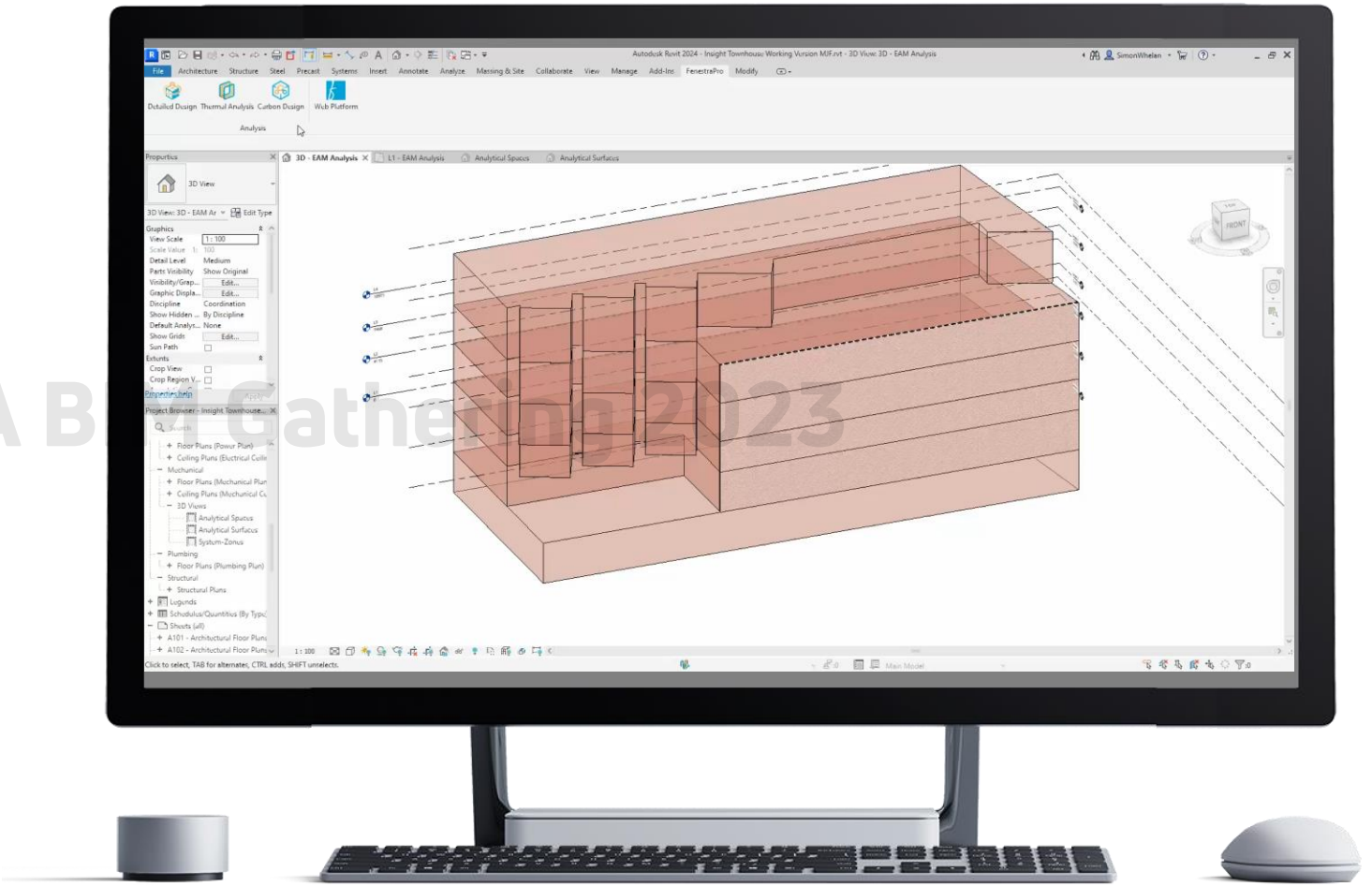

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Workflow 6

Conceptual Massing and Building Elements

- Identify material properties in building element families.
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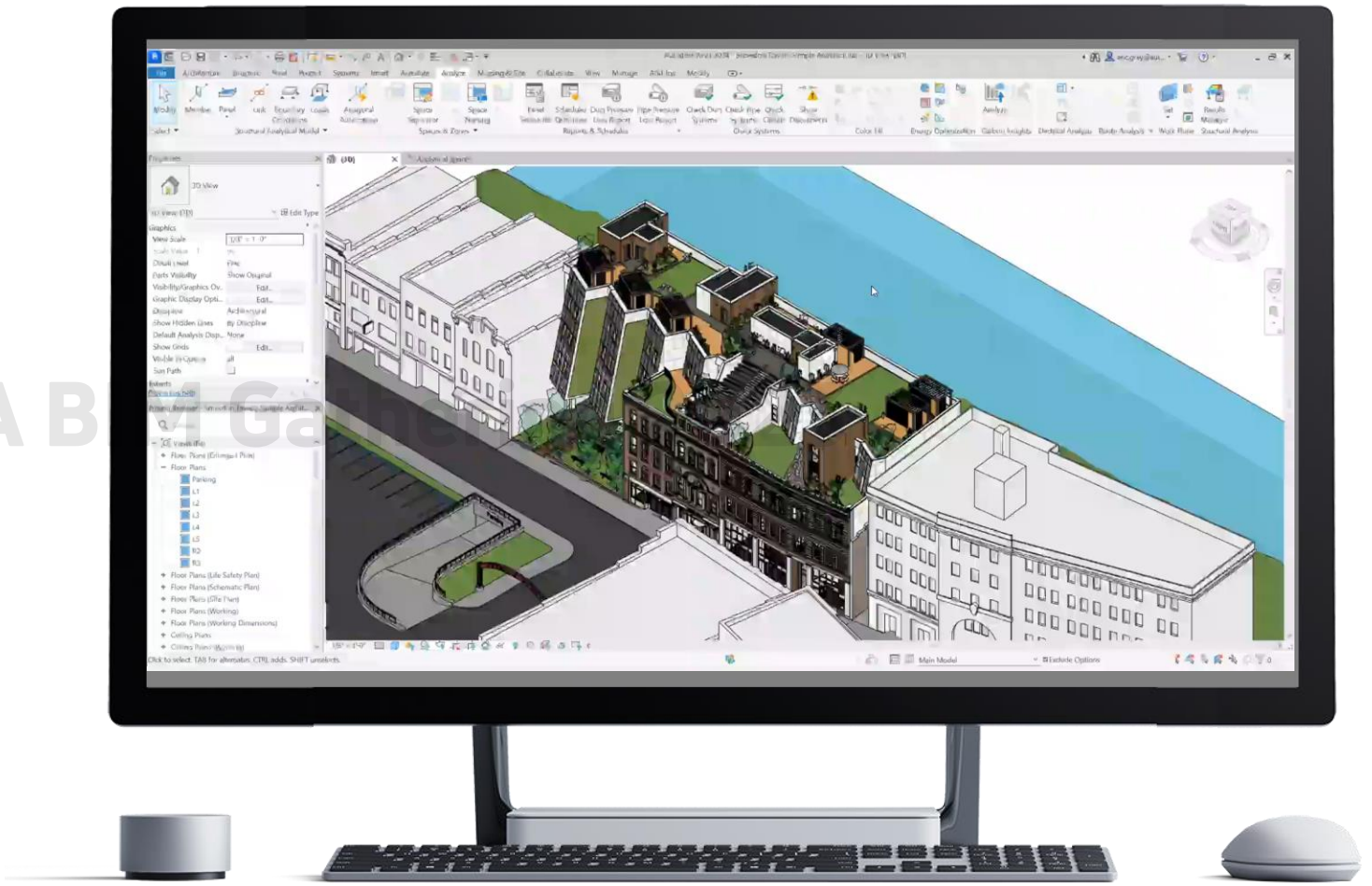

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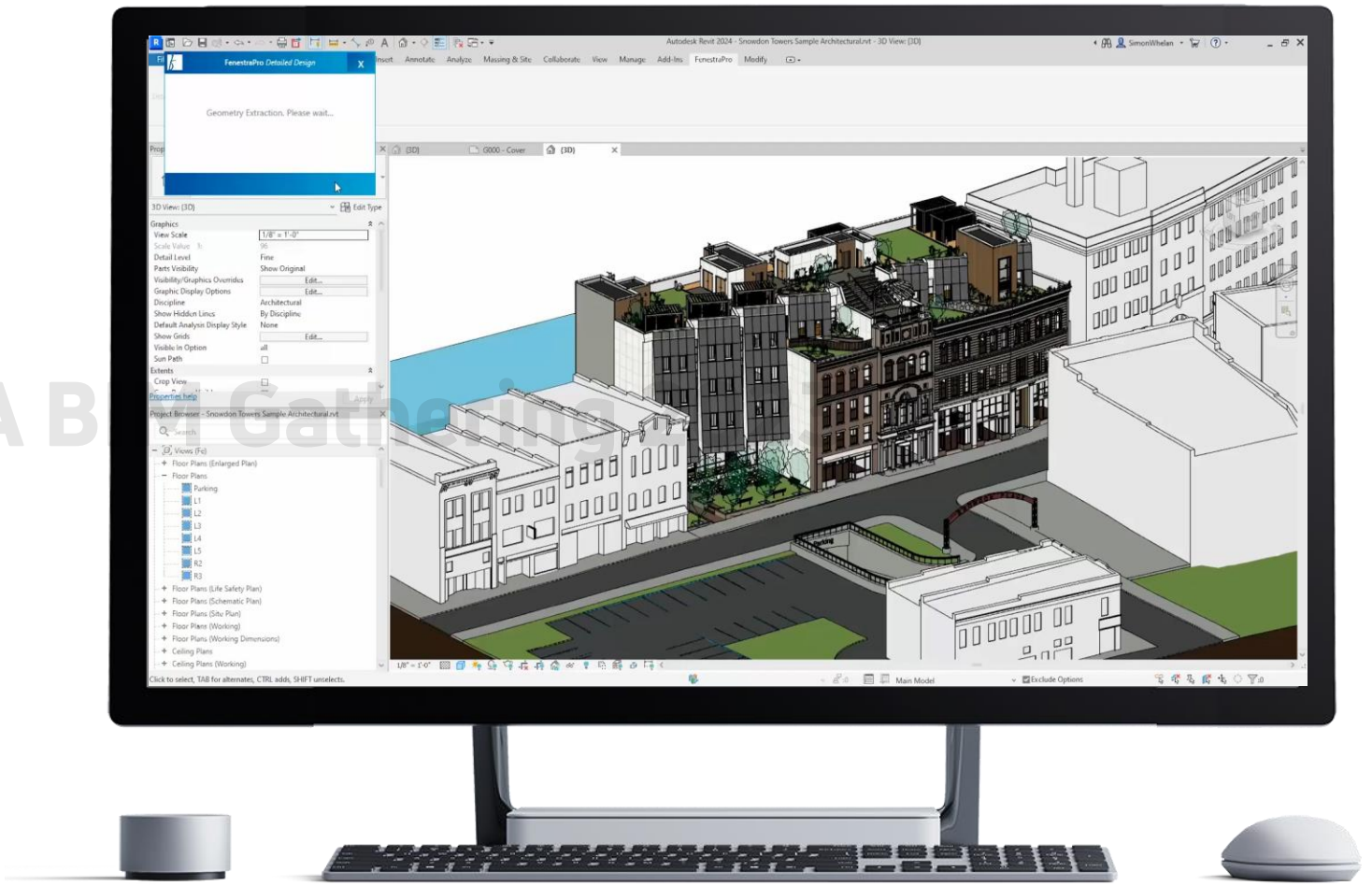
FenestraPro

- Advice on model issues
- Assign missing performance properties
- Visualise issues
- Review warnings



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