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BIM-Driven Engineering: Structural Design Without Redundant Workload

Seth Roswurm, PE, SE

Senior Structural Engineer, API Integrations

Maher (Mack) Eltarhoni, PE, SE (OK)

Principal

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Speakers



Seth Roswurm, PE, SE

Senior Structural Engineer, API Integrations



- Structural design across various market sectors
 - Multi-family
 - Office / commercial
 - Healthcare
 - Educational
 - Government
 - Aviation
- Lead developer - ENERCALC for Revit



Maher (Mack) Eltarhoni, PE, SE (OK)

Principal



- General structural engineering services
- Delegated design of CFS Specialty Engineering
- Revit-focused production methods

Topics

- Time is money: Assessing hidden costs of parallel work
- Intentional Integration: How to think BIM-centric and model purposefully
- Case Study: Revit-driven design of steel beam and girders



The Cost of Parallel Work



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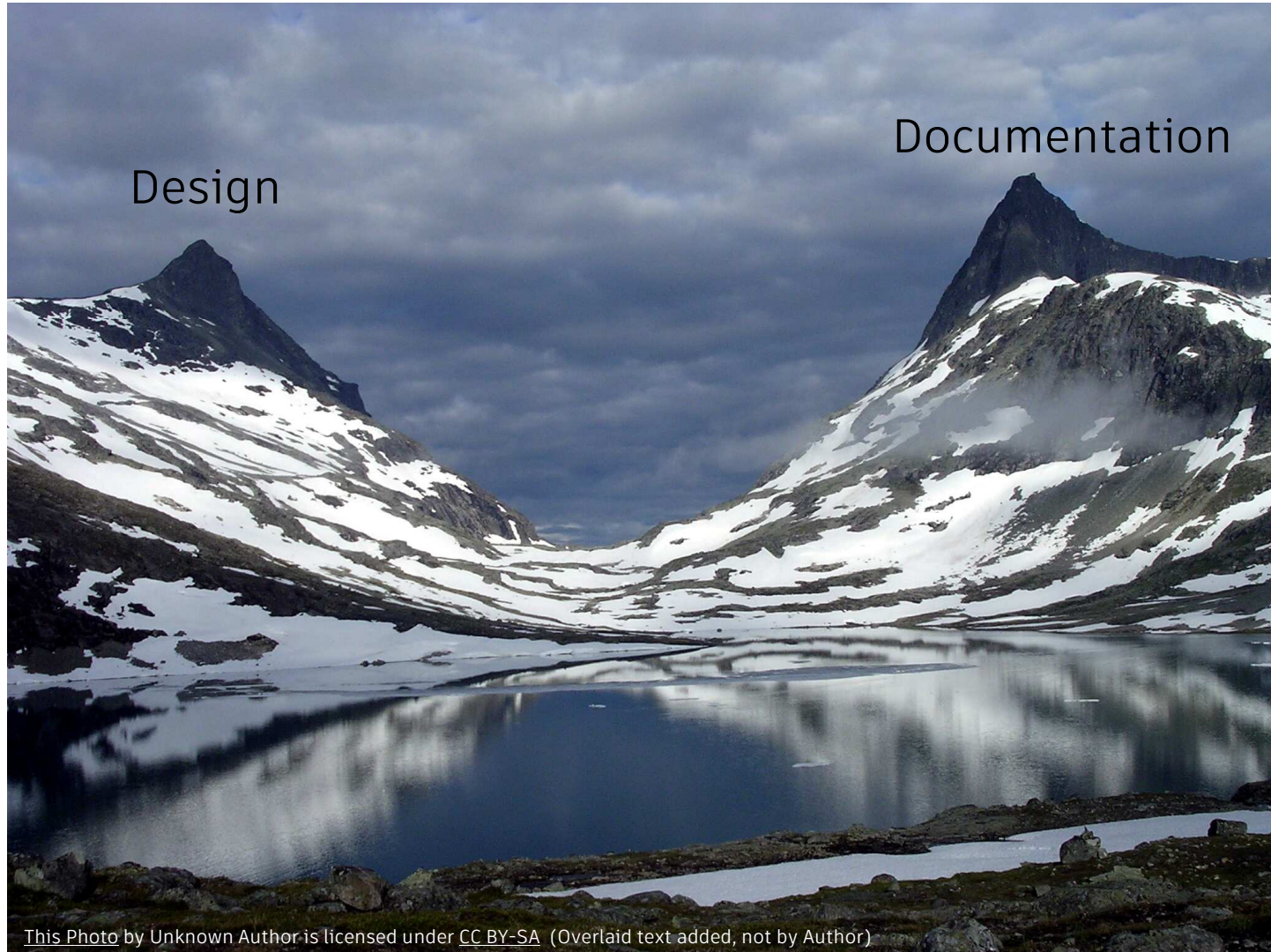
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Documentation



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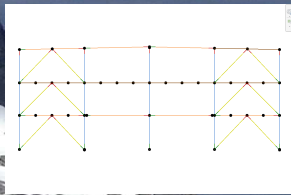
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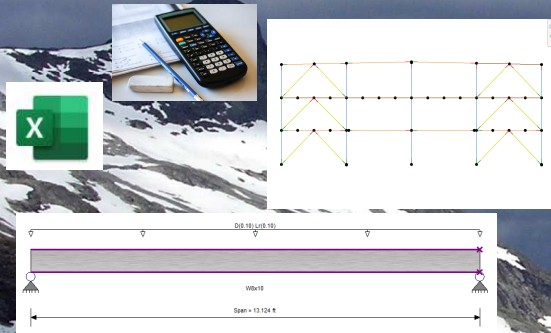


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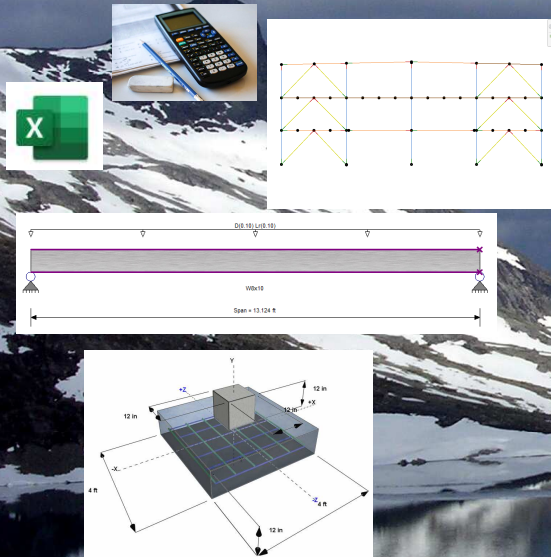
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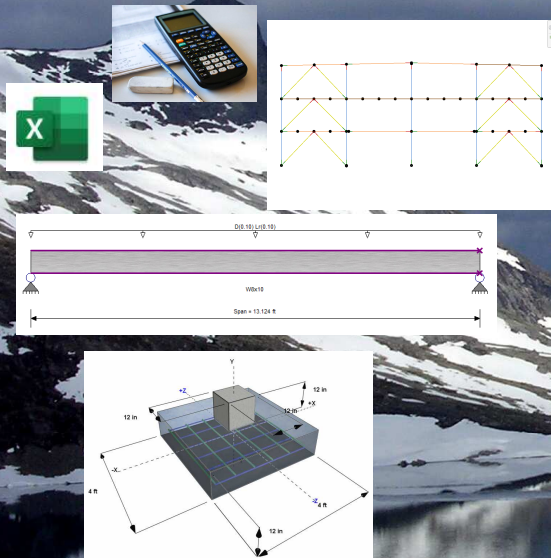
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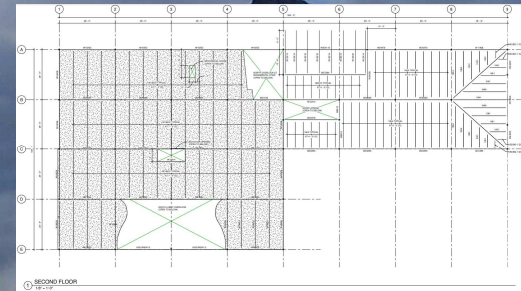


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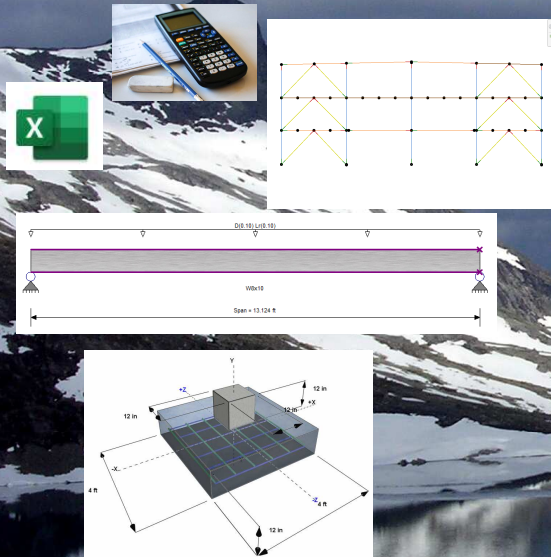


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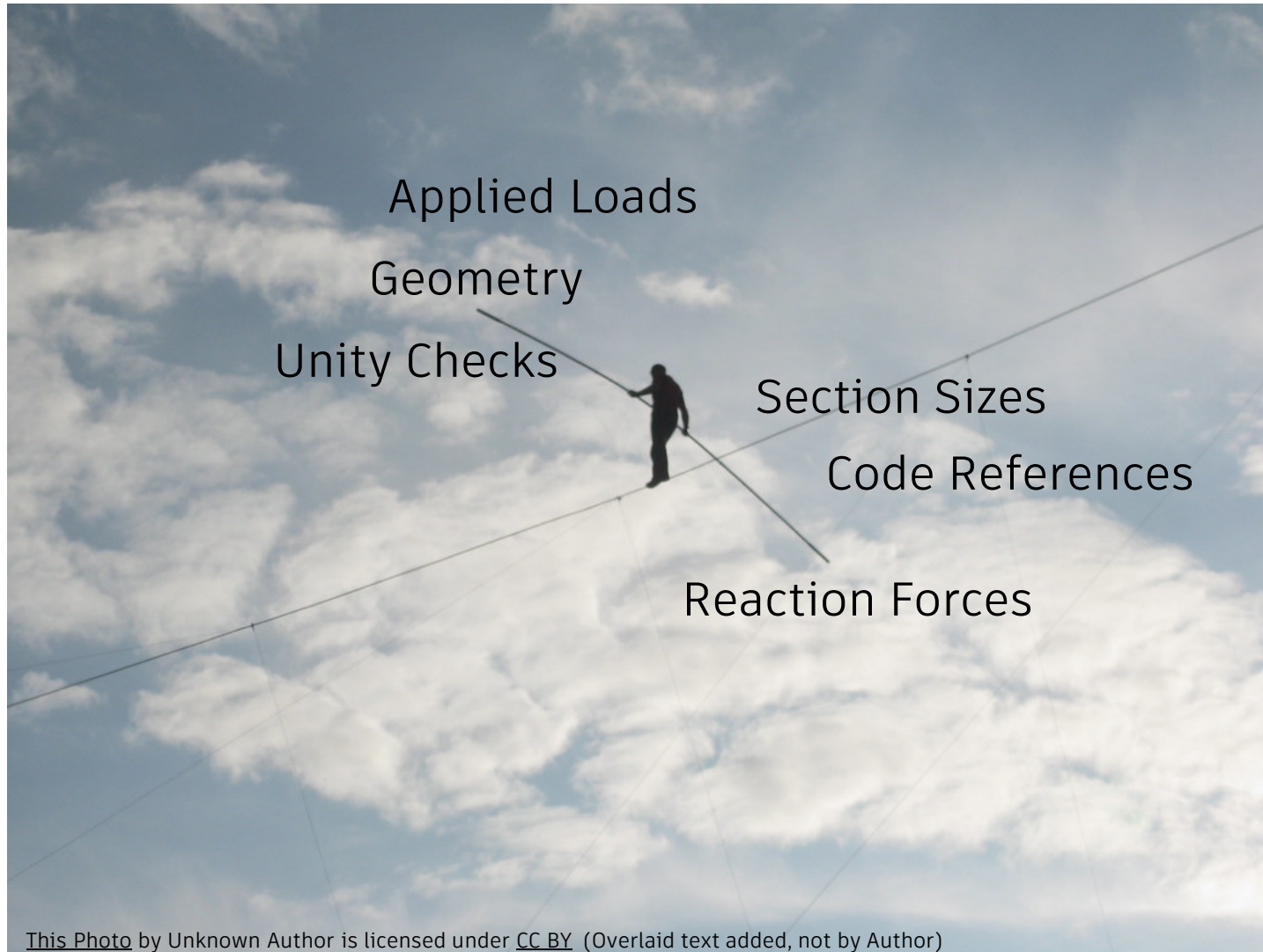
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Applied Loads

Geometry

Unity Checks

Section Sizes

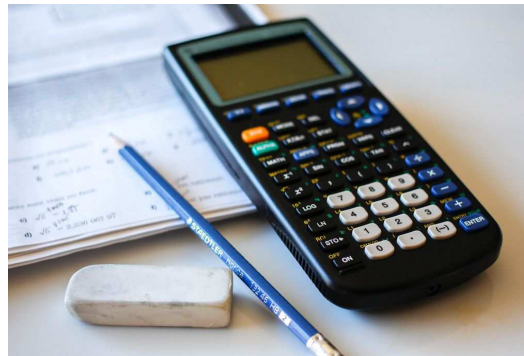
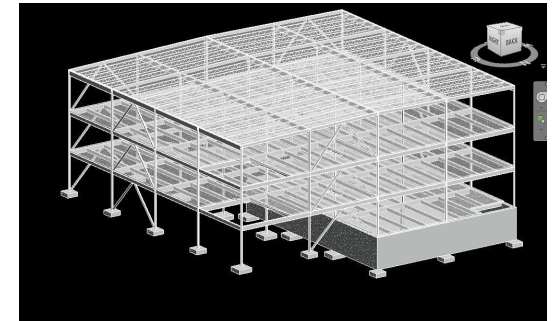
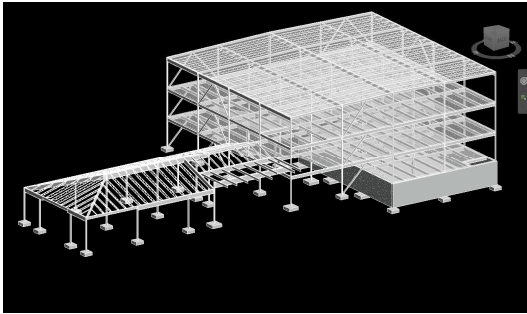
Code References

Reaction Forces

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The building design lifecycle

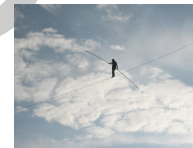
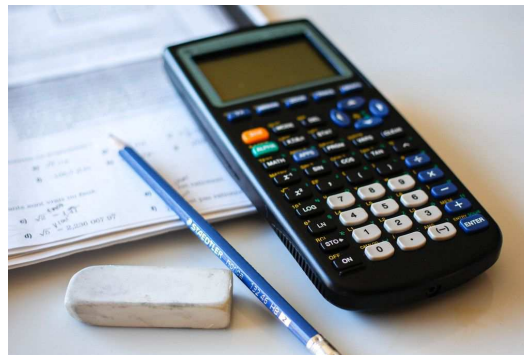
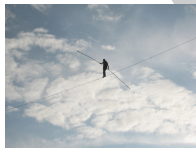
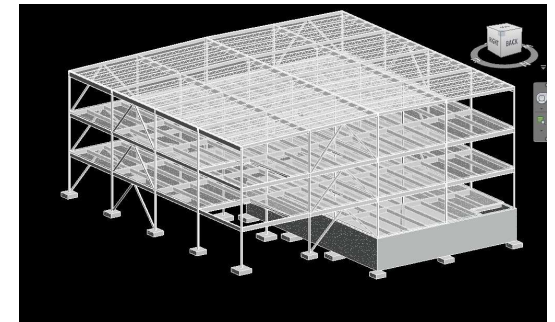
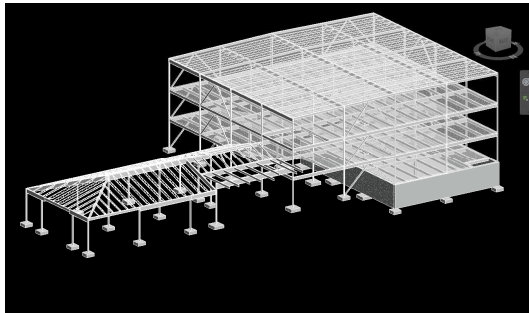
“See updated 50% DD ARCH drawings...”
“Upcoming scope change...”
“Per client review comments...”
“The city code official has required...”



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The building design lifecycle

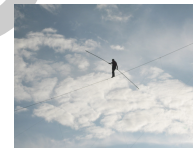
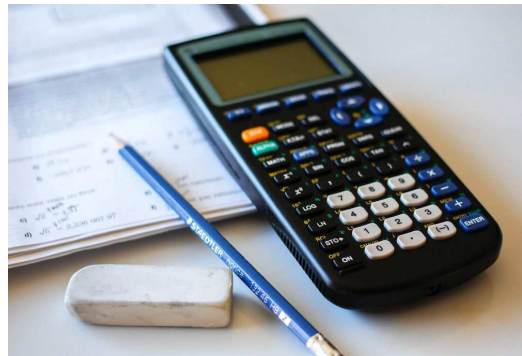
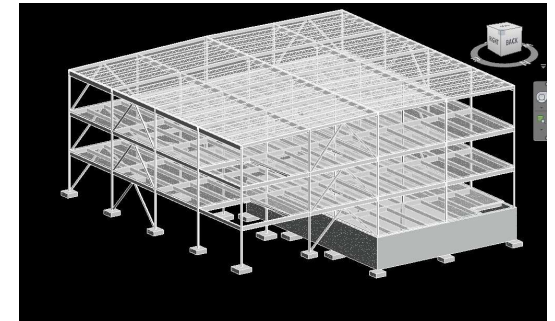
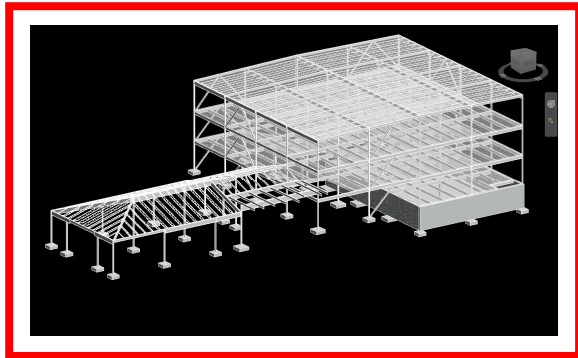
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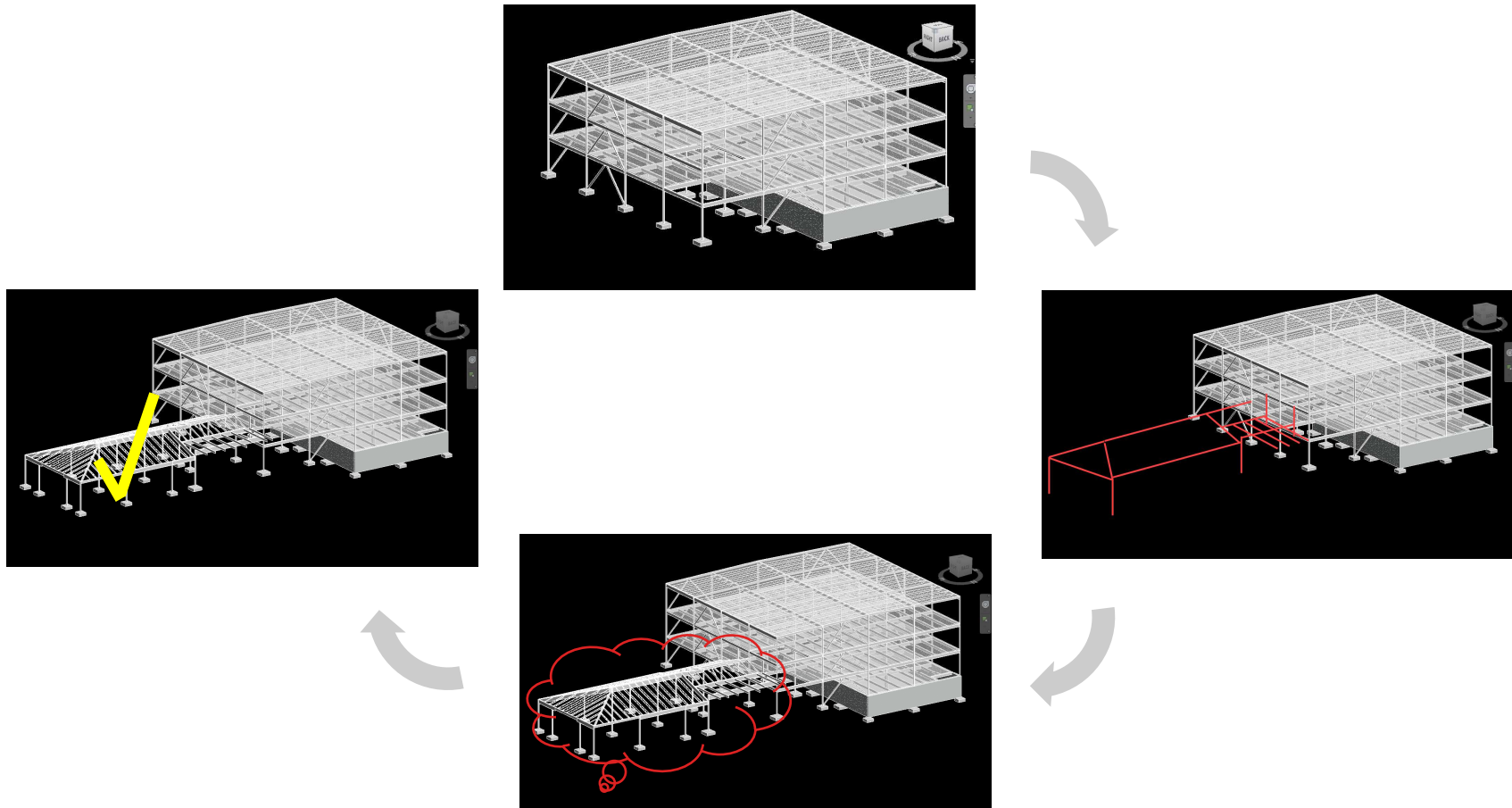
The building design lifecycle

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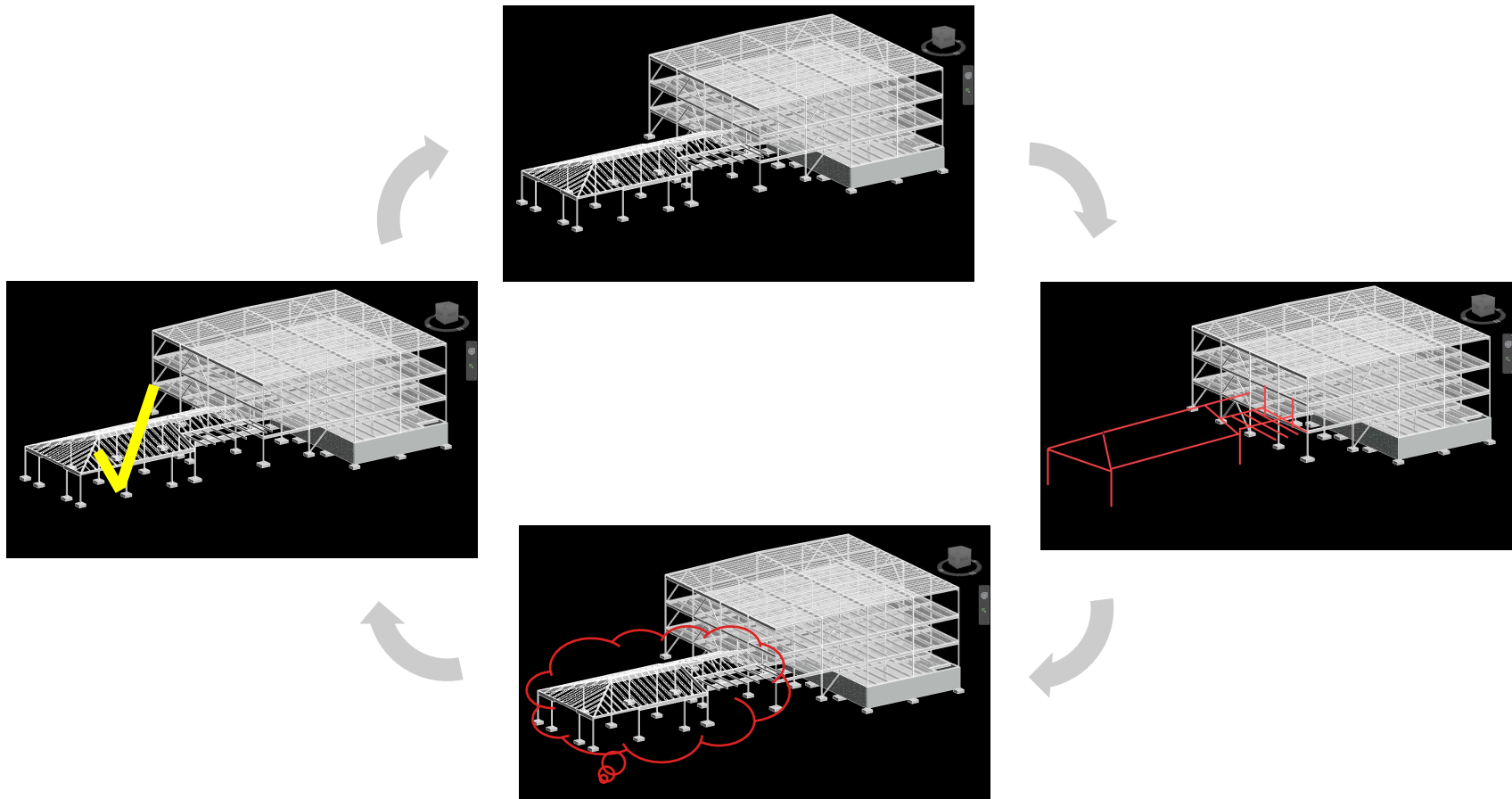


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The structural documentation lifecycle



The structural documentation lifecycle





Think Revit-centric

Think Revit-centric

- Think about the tight rope

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- Fewer trips across the chasm is better (more accurate, more profitable, etc.)

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- Firms already invest significant time modeling structure in Revit for coordination and documentation

Think Revit-centric

- Think about the tight rope
- Fewer trips across the chasm is better (more accurate, more profitable, etc.)
- Firms already invest significant time modeling structure in Revit for coordination and documentation
- Why not leverage it for design too?

Think Revit-centric

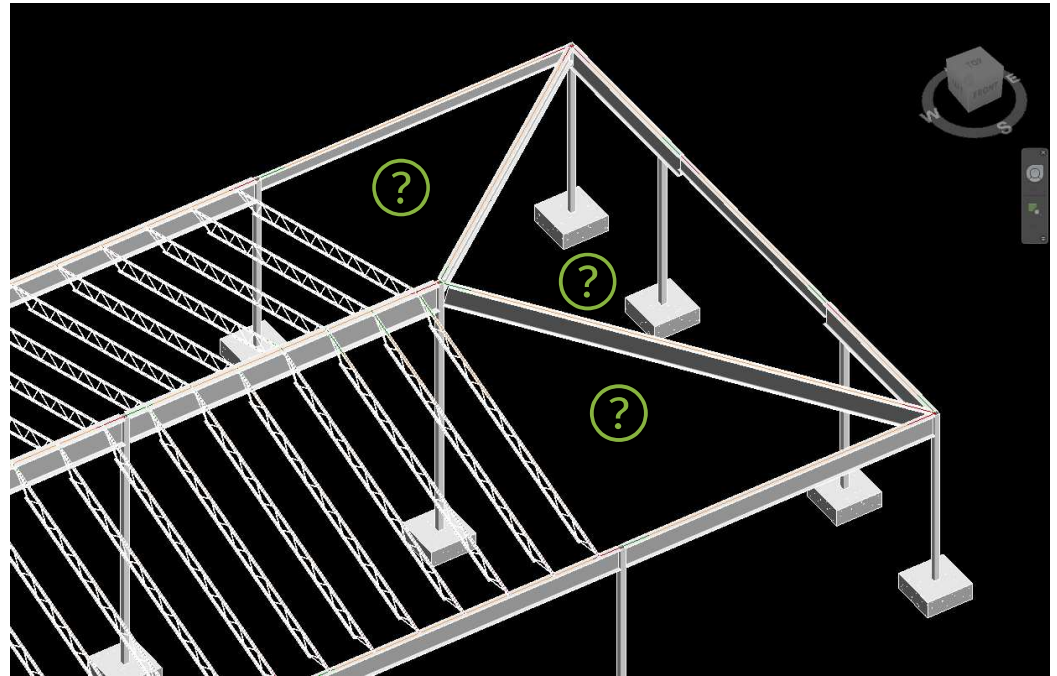
- What are the cornerstones of Revit's capabilities?
 - Annotation: 2D drafting tools, detail items, dimensioning, smart tagging, etc.
 - Modeling: Powerful 3D framing and dynamic model views
 - Parametric: Robust parameter framework and intelligent scheduling
 - API: Industry-leading programming interface for extending functionality

Think Revit-centric: Best practices?

- Revit is a data-rich environment – Use it!
- Avoid workflows that are data-poor, non-parametric, and static
- Thorough and accurate modeling helps unlock the full power of the platform
- These best practices are applicable for anything, including basic model management, scheduling / takeoffs, and even actual Revit-driven structural design

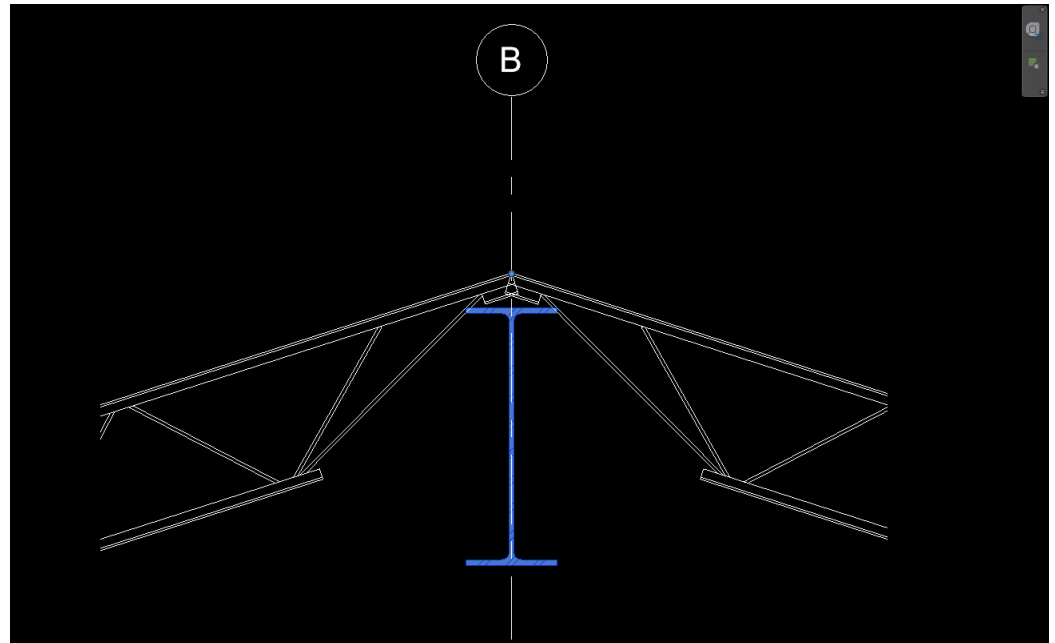
Think Revit-centric: Best practices?

- Line work (framing and scheduling)



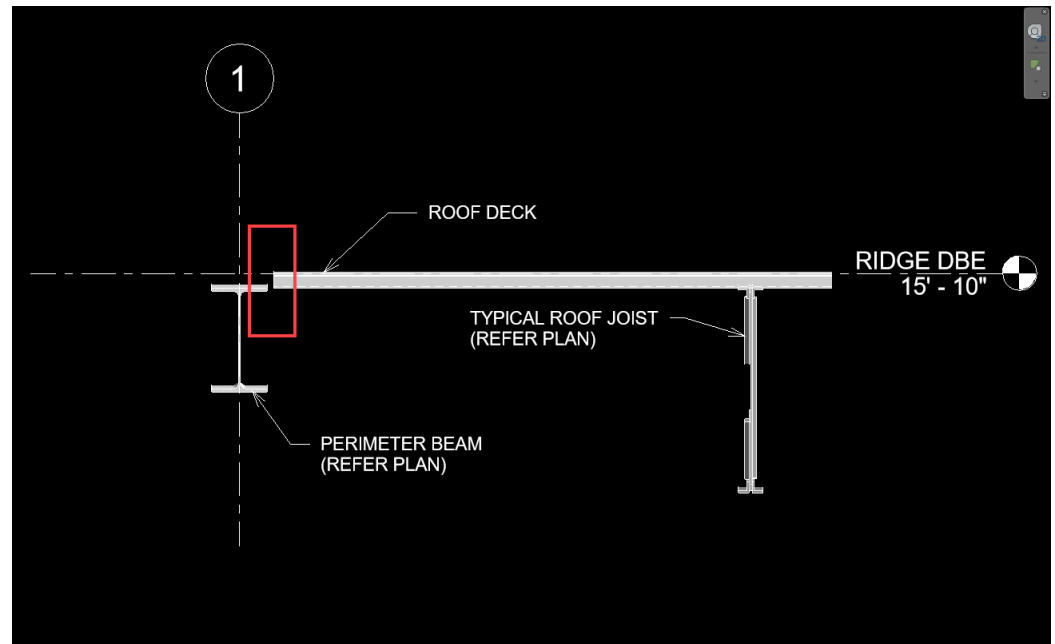
Think Revit-centric: Best practices?

- Line work (framing and scheduling)
- Joins, cutbacks, and Z-offsets



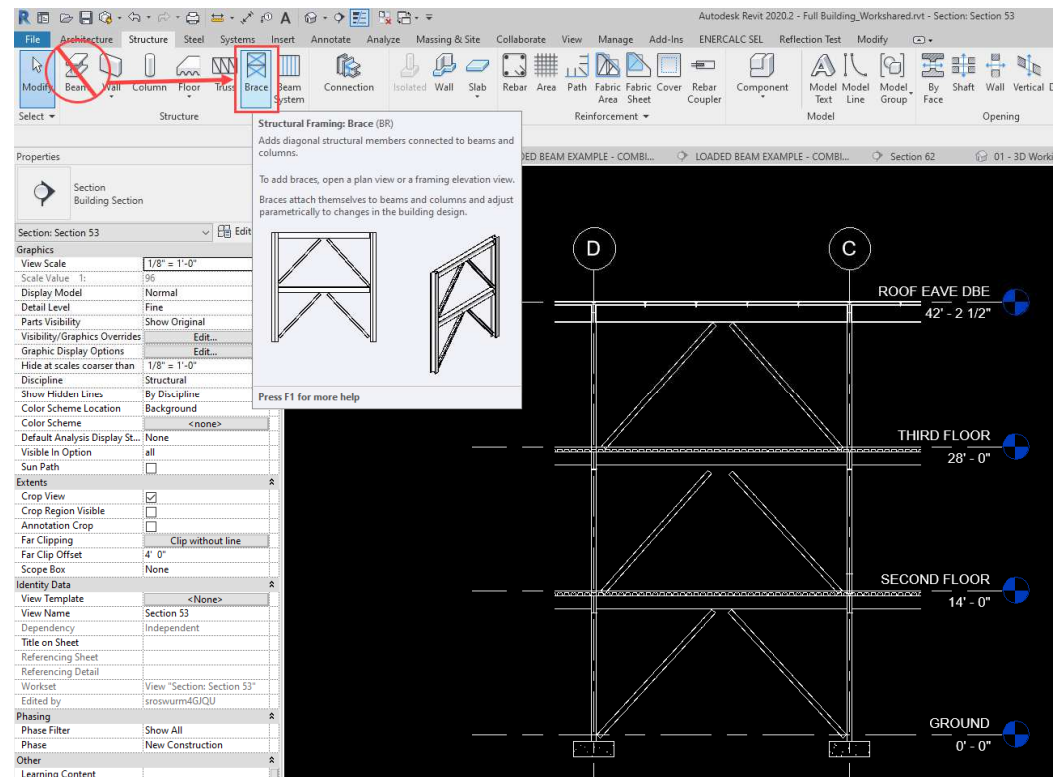
Think Revit-centric: Best practices?

- Line work (framing and scheduling)
- Joins, cutbacks, and Z-offsets
- Floor edge support conditions



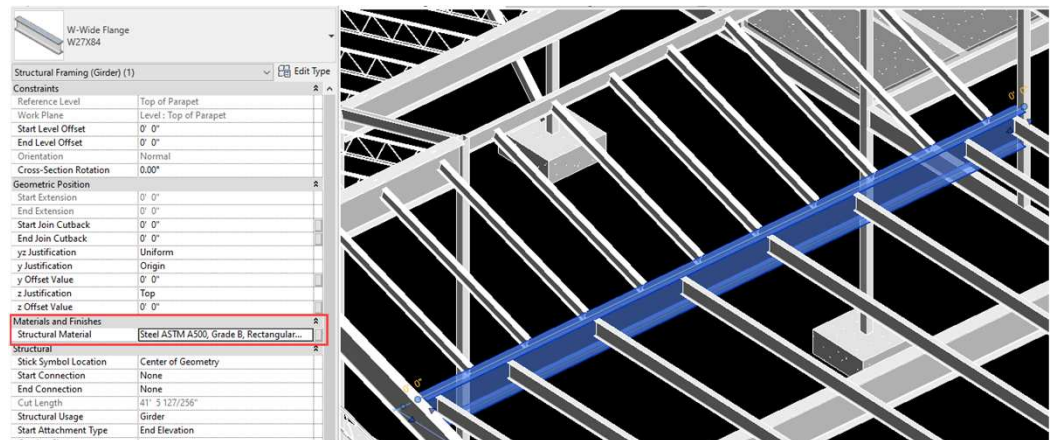
Think Revit-centric: Best practices?

- Line work (framing and scheduling)
- Joins, cutbacks, and Z-offsets
- Floor edge support conditions
- Structural types and usages



Think Revit-centric: Best practices?

- Line work (framing and scheduling)
- Joins, cutbacks, and Z-offsets
- Floor edge support conditions
- Structural types and usages
- **Structural materials**

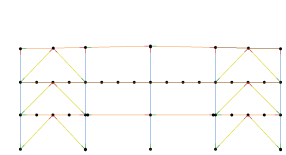


Think Revit-centric: How to adapt?

- Revit-connected standalone design software?

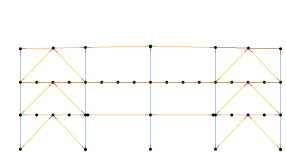
Think Revit-centric: How to adapt?

- Revit-connected standalone design software?
- Bulk export to another environment / data exchange files
- Managing Revit analytical modeling / parallel models



Think Revit-centric: How to adapt?

- Revit-connected standalone design software?
- Bulk export to another environment / data exchange files
- Managing Revit analytical modeling / parallel models
- Still making laborious trips back and forth
- There must be a better way...



Think Revit-centric: How to adapt?

- What if you could design without any trips to another environment?
- Revit-centric structural design software:
 - Perform structural design from directly inside Revit
 - Let Revit be the convergence point – No more tight rope walks!
 - Eliminate the risk of data transcription errors

ENERCALC SEL

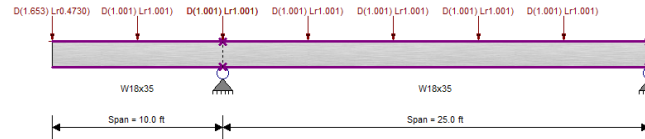


- Over 40 structural engineering calculation modules for common design tasks

ENERCALC SEL



- Over 40 structural engineering calculation modules for common design tasks
- Design of structural components

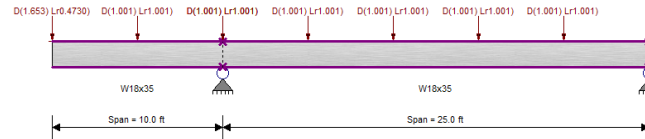


ENERCALC SEL



- Over 40 structural engineering calculation modules for common design tasks

- Design of structural components



- Structural analysis modules



2D Frame



Rigid Diaphragm Torsion



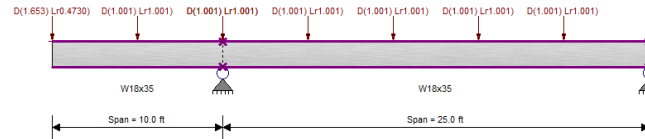
Pile Group Analysis

ENERCALC SEL



- Over 40 structural engineering calculation modules for common design tasks

- Design of structural components



- Structural analysis modules



2D Frame



Rigid Diaphragm Torsion



Pile Group Analysis

- Earth retention modules



Cantilevered Wall



Restrained Wall



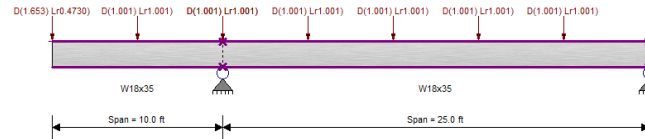
Gravity Wall

ENERCALC SEL



- Over 40 structural engineering calculation modules for common design tasks

- Design of structural components



- Structural analysis modules



- Earth retention modules

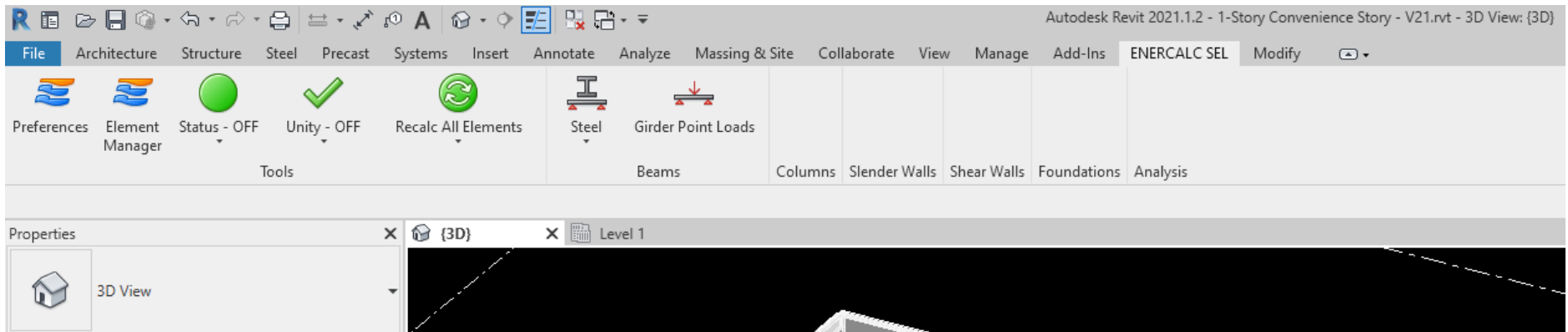


- 3D frame analysis and FEM solutions



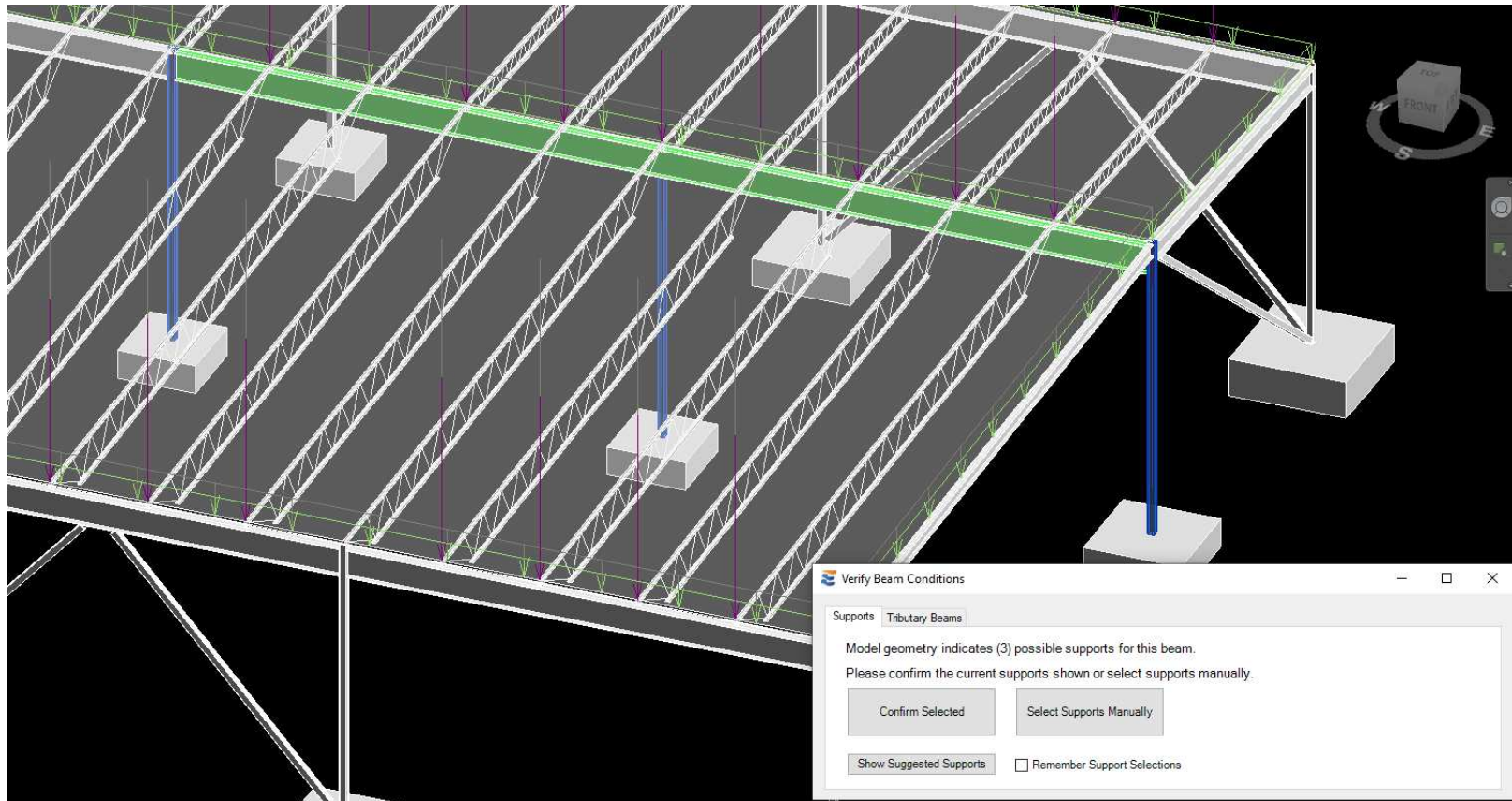
ENERCALC for Revit

Familiar Revit-based ribbon bar controls...



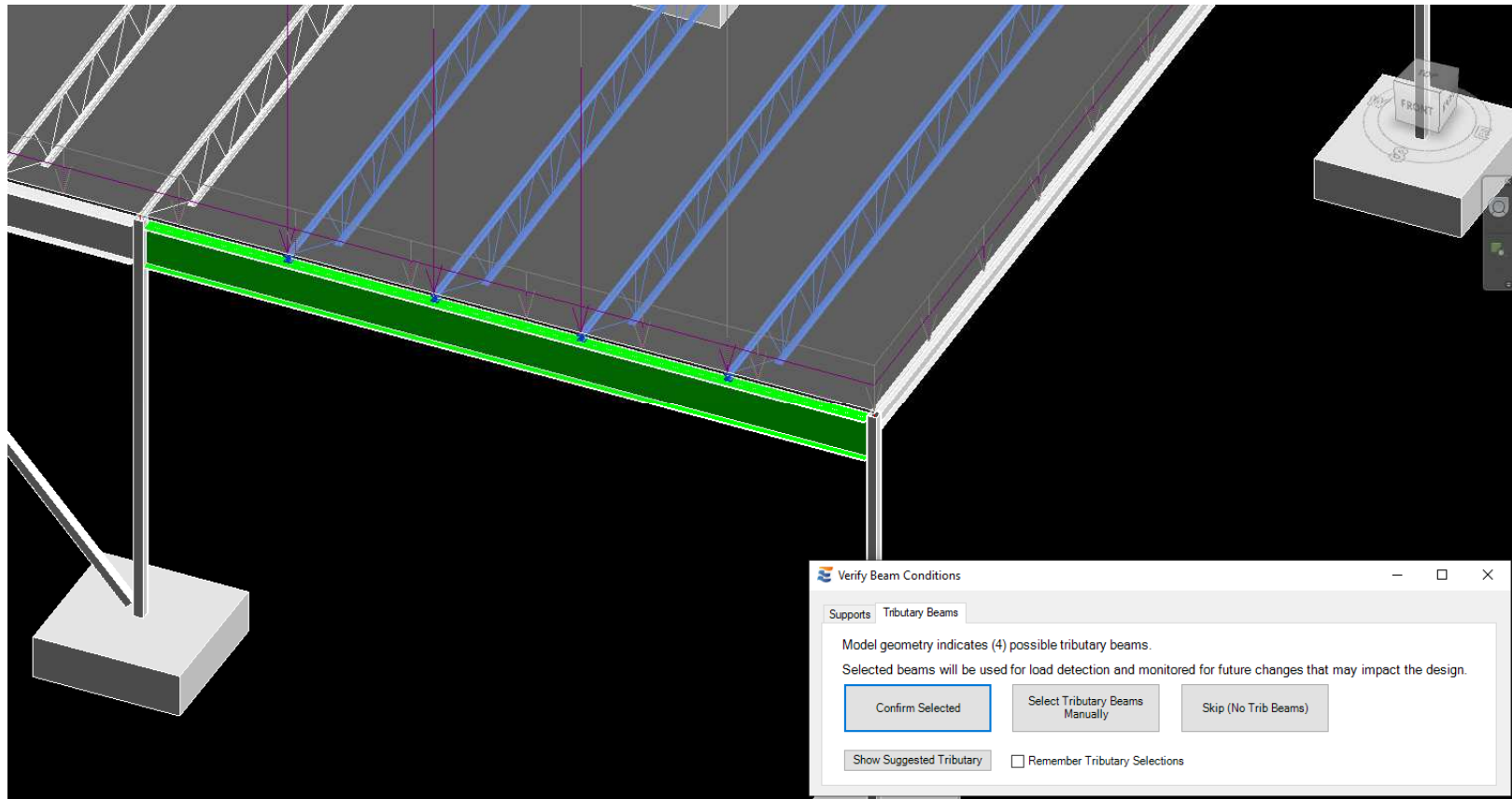
ENERCALC for Revit

Intuitive launching of calculations directly from Revit...



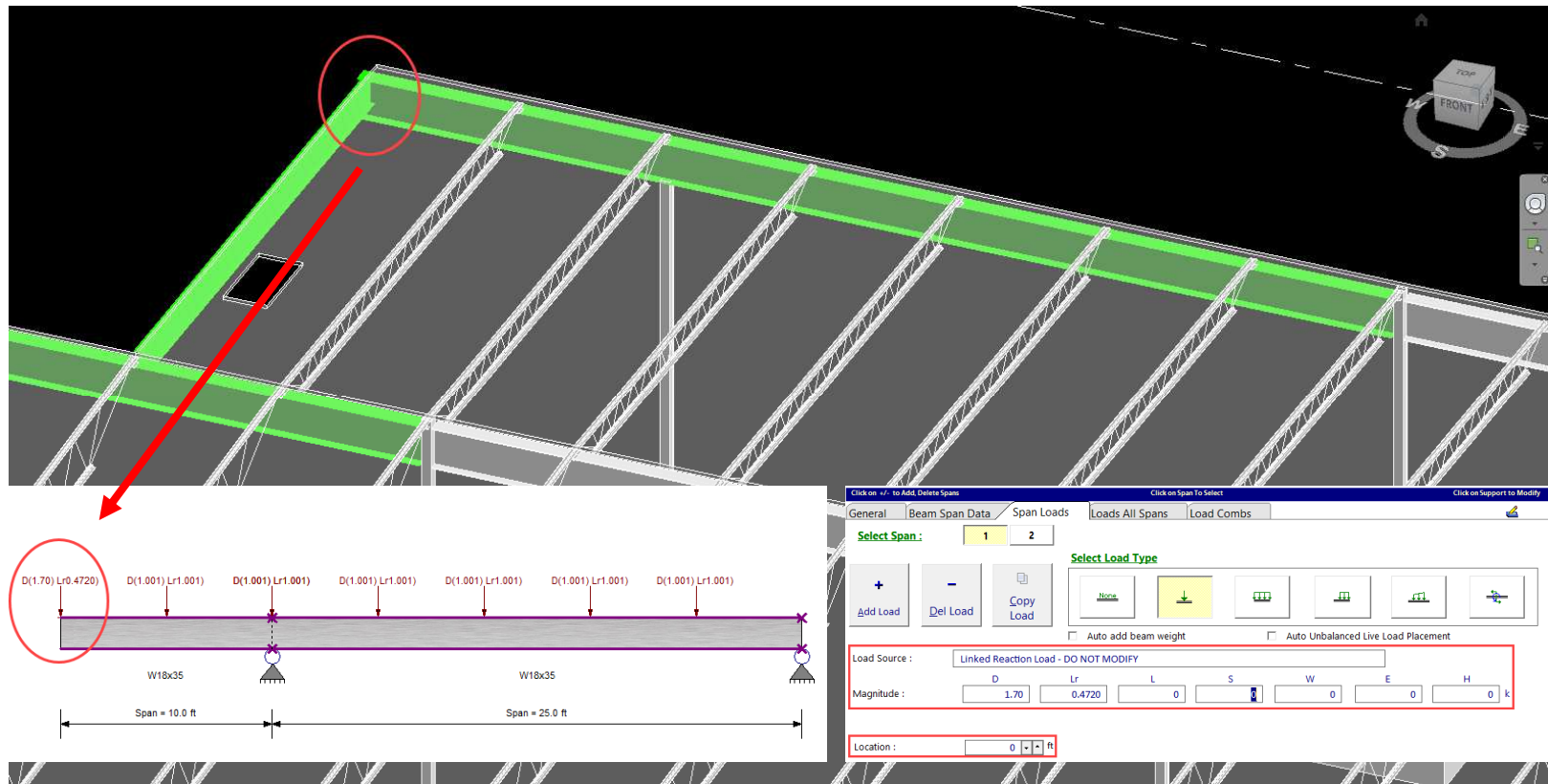
ENERCALC for Revit

Leverage Revit model structural geometry to eliminate parallel work...



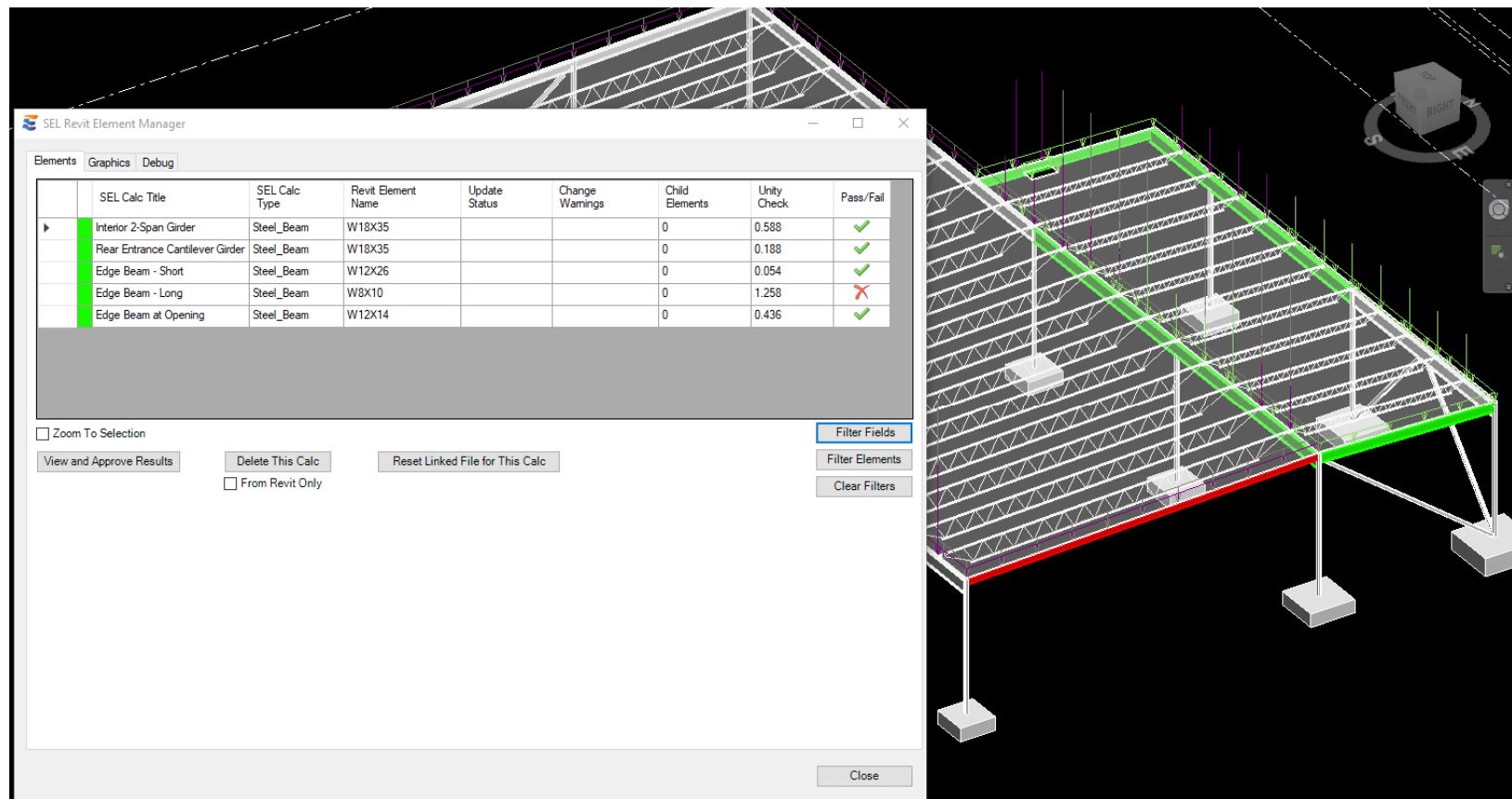
ENERCALC for Revit

Auto-linking of loads between connected element calculations...



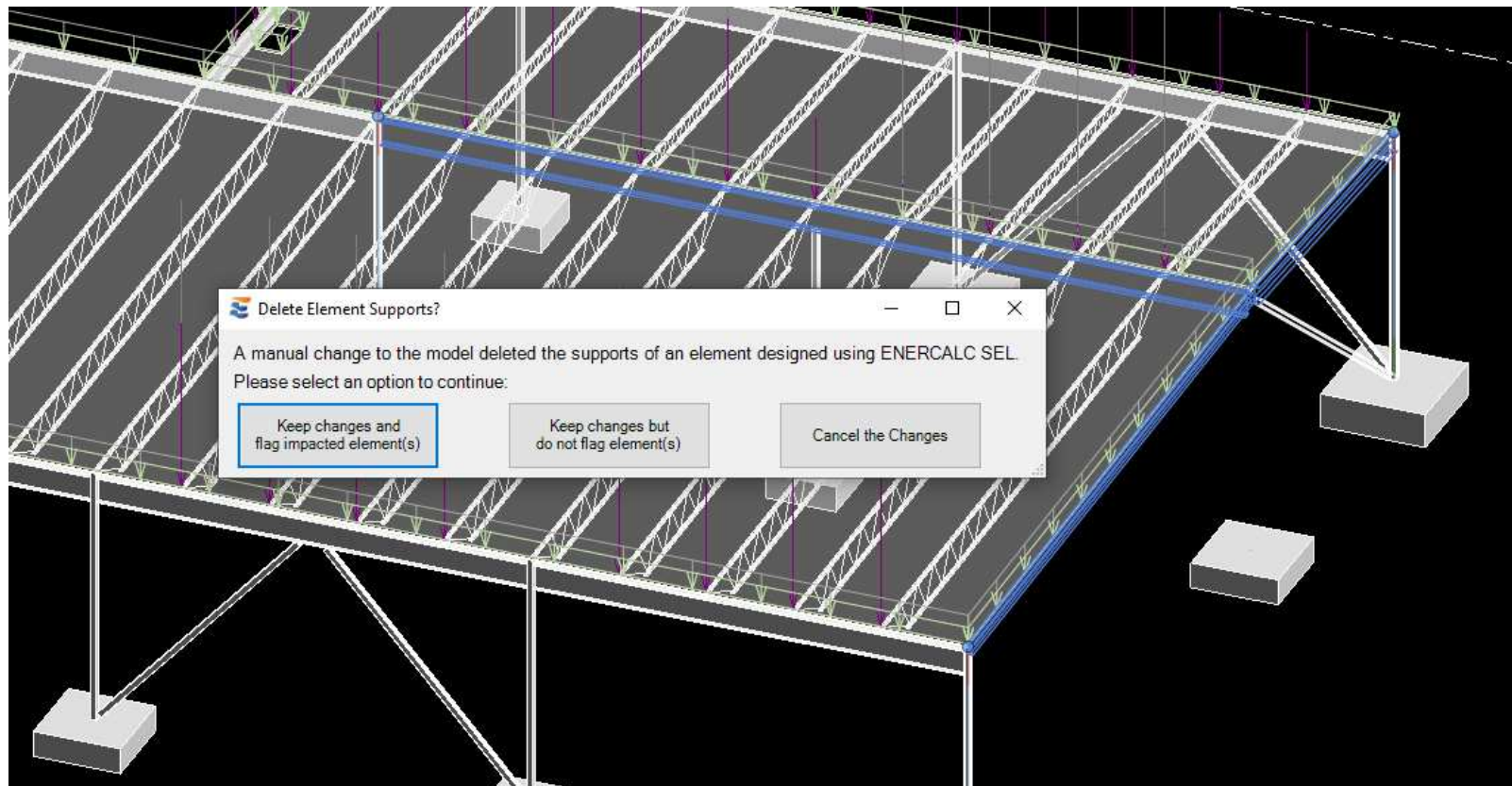
ENERCALC for Revit

Rich visuals for managing designs inside the Revit environment...



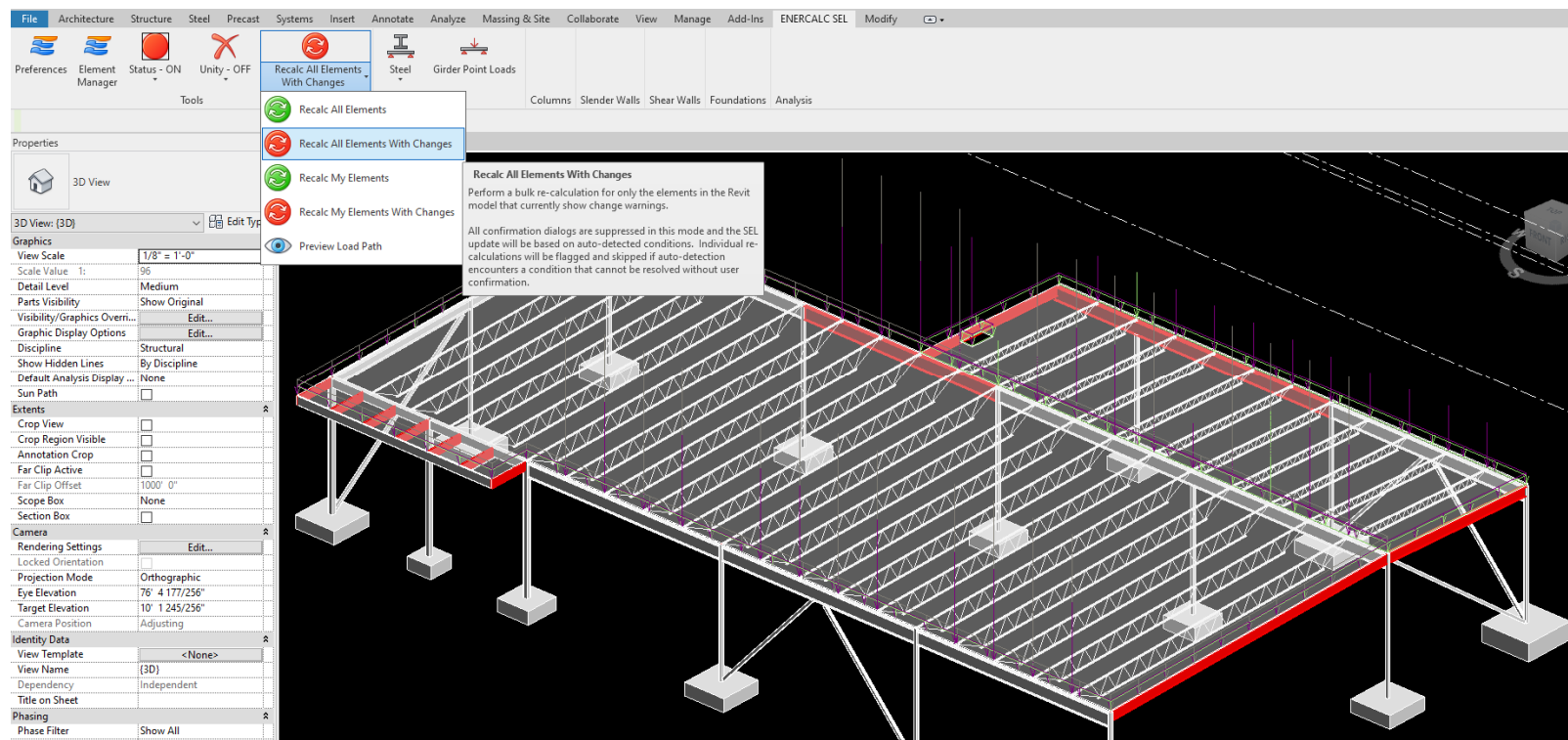
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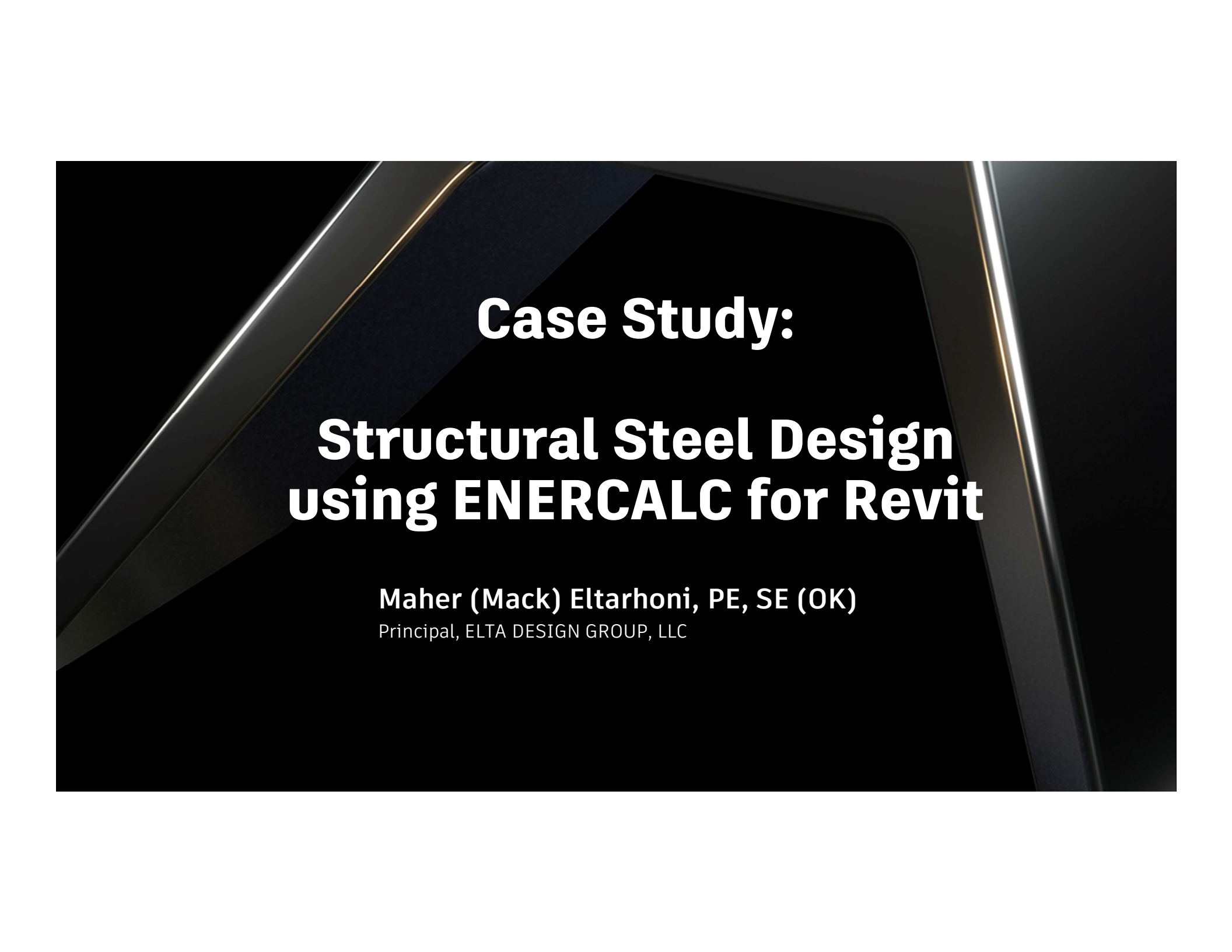
Real-time oversight of model changes that impact element designs...



ENERCALC for Revit

Easy updating via bulk recalculation tools...





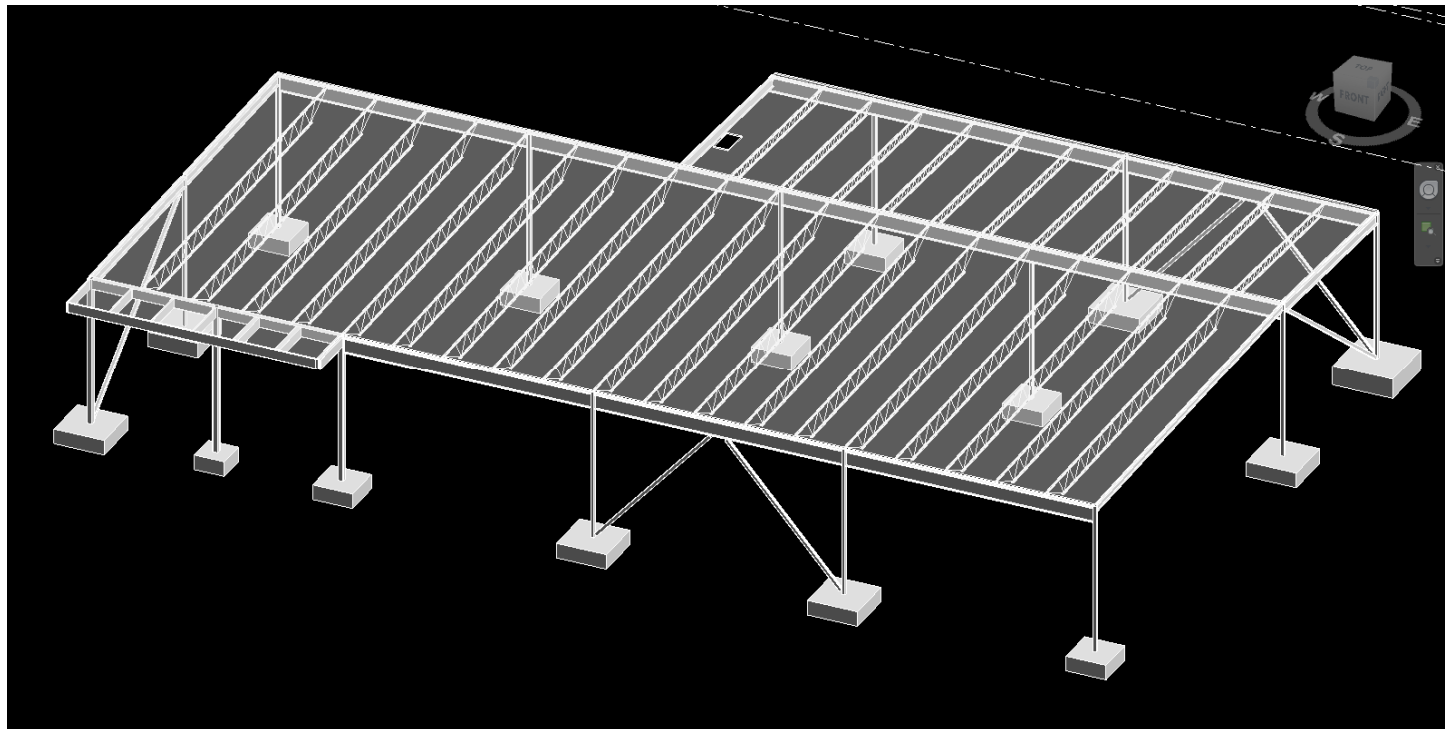
Case Study:

Structural Steel Design using ENERCALC for Revit

Maher (Mack) Eltarhoni, PE, SE (OK)
Principal, ELTA DESIGN GROUP, LLC

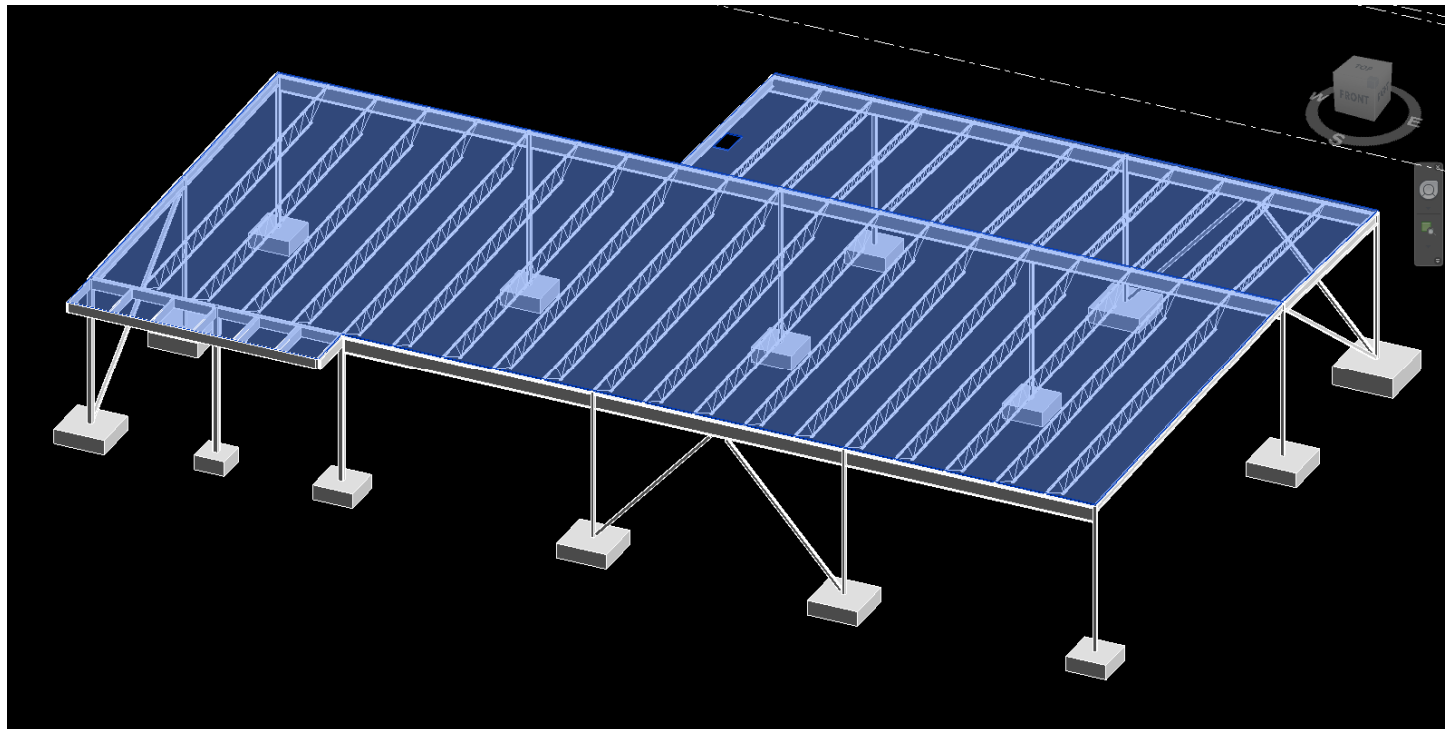
Case Study Structure

- Convenience store: Single-story steel framed



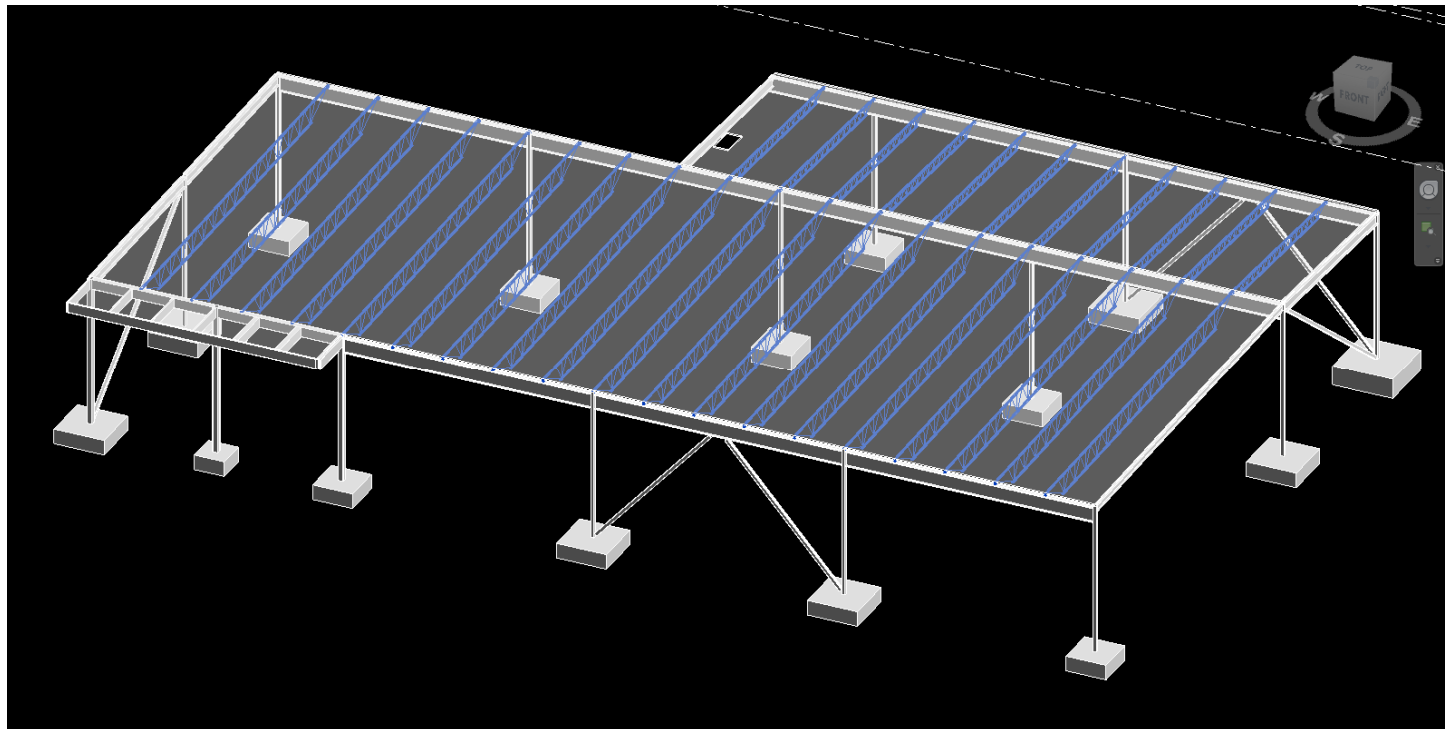
Case Study Structure

- Convenience store: Single-story steel framed
- Steel deck



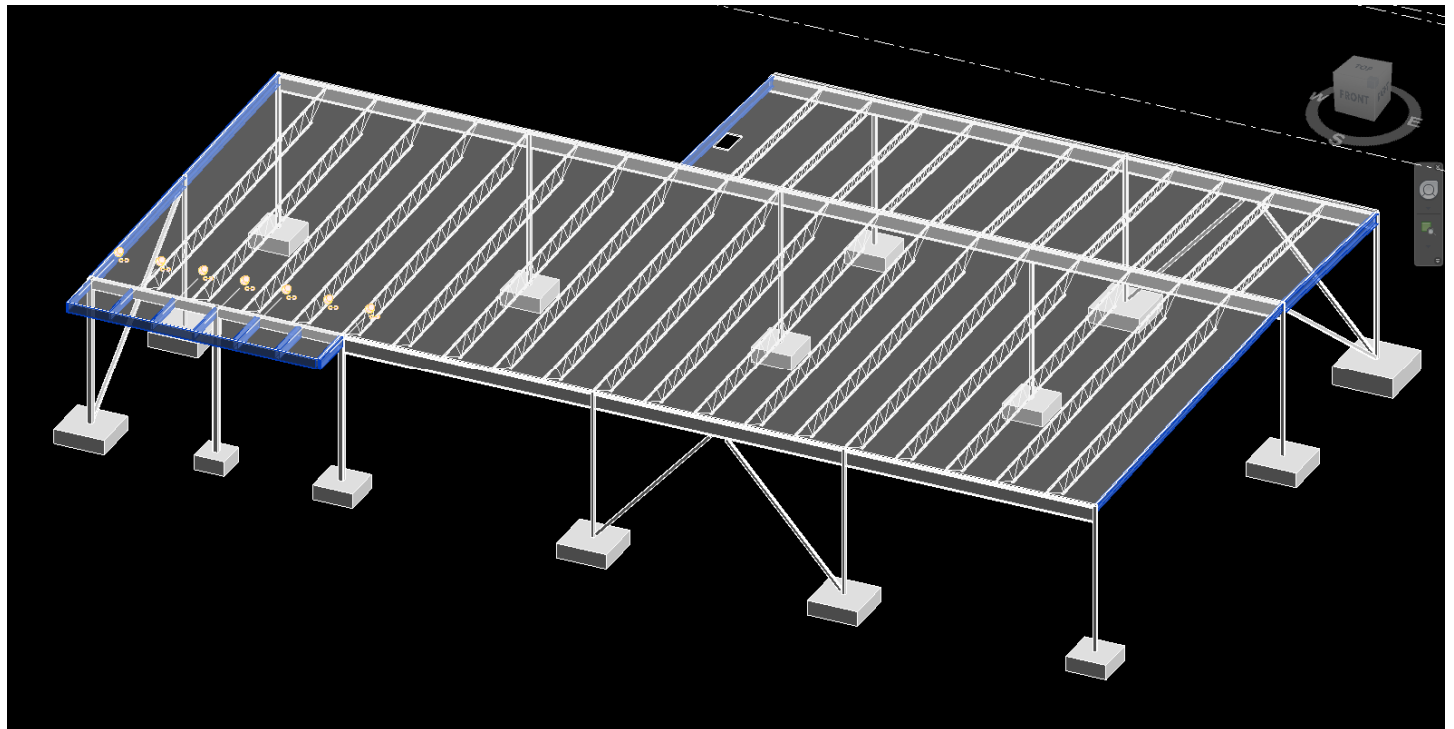
Case Study Structure

- Convenience store: Single-story steel framed
- Steel deck
- Open-web joists



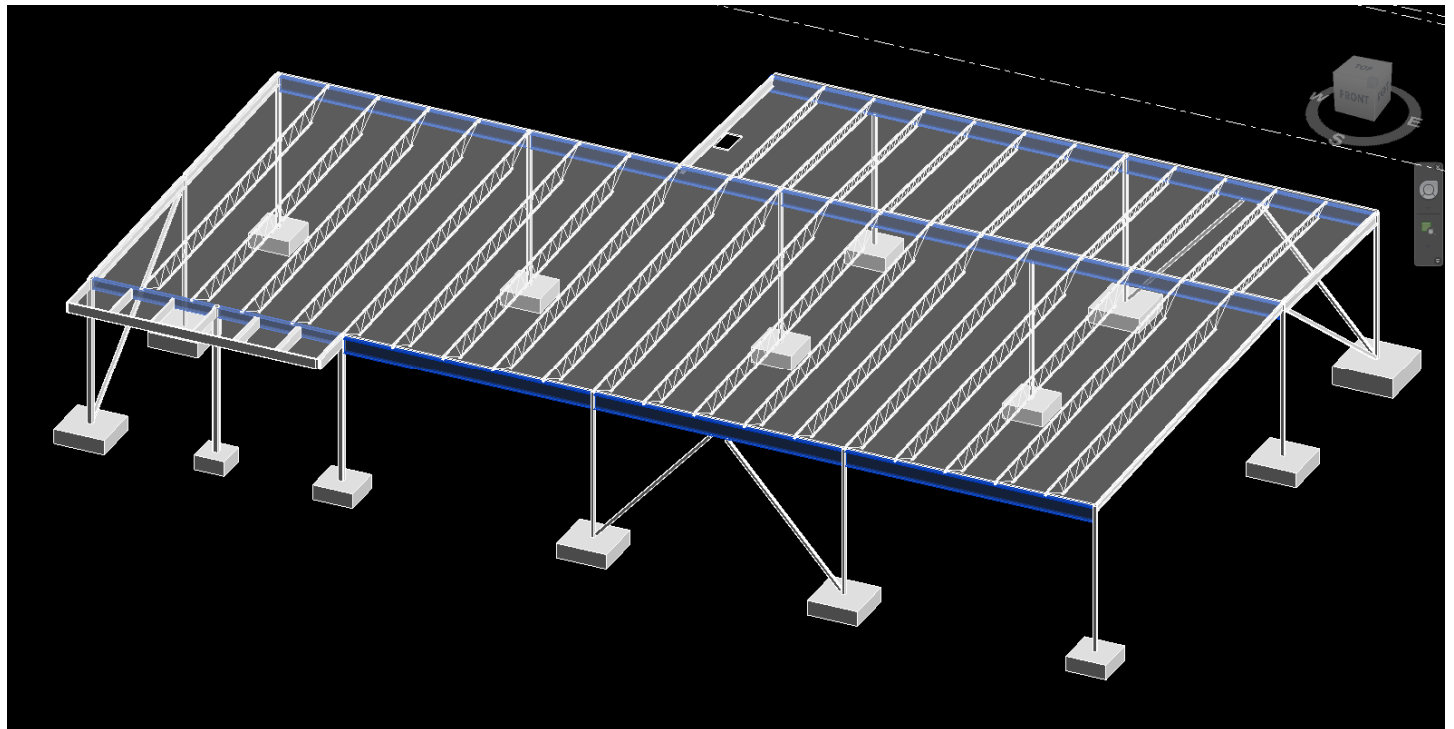
Case Study Structure

- Convenience store: Single-story steel framed
- Steel deck
- Open-web joists
- **Steel beams**



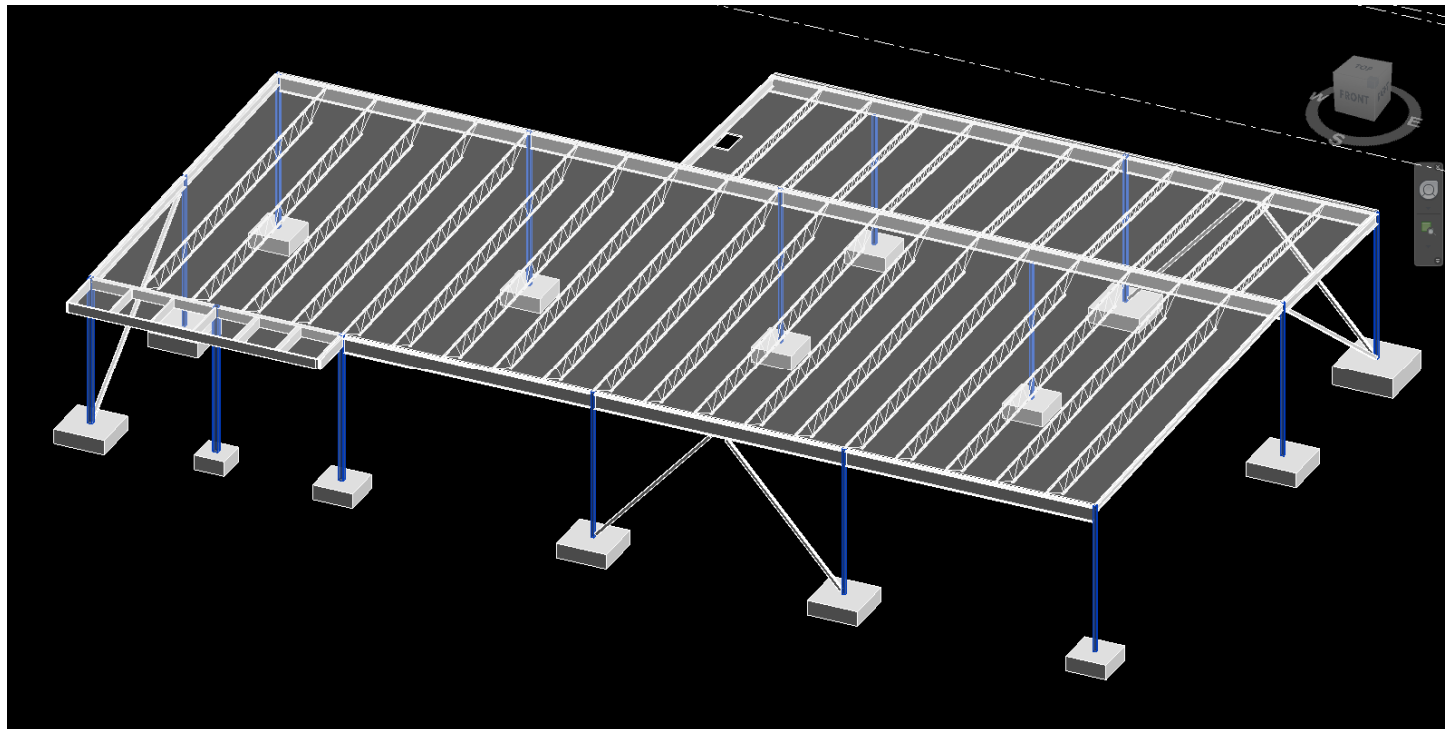
Case Study Structure

- Convenience store: Single-story steel framed
- Steel deck
- Open-web joists
- Steel beams
- **Steel girders**



Case Study Structure

- Convenience store: Single-story steel framed
- Steel deck
- Open-web joists
- Steel beams
- Steel girders
- Steel columns



Case Study: Conclusions

- Generate new calculations instantaneously
- Easily edit existing calculations with 2-way controls
- Powerful Revit visuals to overview completion status and code compliance
- Rapidly “what if” designs via model change tracking and fast recalc tools
- Fast and easy record keeping for calcs
- Load linking for reactions

ENERCALC for Revit

Steel beam is just the beginning...



ENERCALC for Revit

Steel beam is just the beginning...



- ENERCALC users will soon have access to powerful Revit-based design for:
 - Beams and columns of all materials
 - Shear walls and slender walls of all materials
 - Foundation elements
 - Specialty analysis modules

ENERCALC for Revit

Steel beam is just the beginning...



- ENERCALC users will soon have access to powerful Revit-based design for:
 - Beams and columns of all materials
 - Shear walls and slender walls of all materials
 - Foundation elements
 - Specialty analysis modules
- To learn about deploying **ENERCALC SEL** and **ENERCALC for Revit** at your firm:

Seth Roswurm, PE, SE

sroswurm@enercalc.com

<https://enercalc.com/>

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Q & A

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