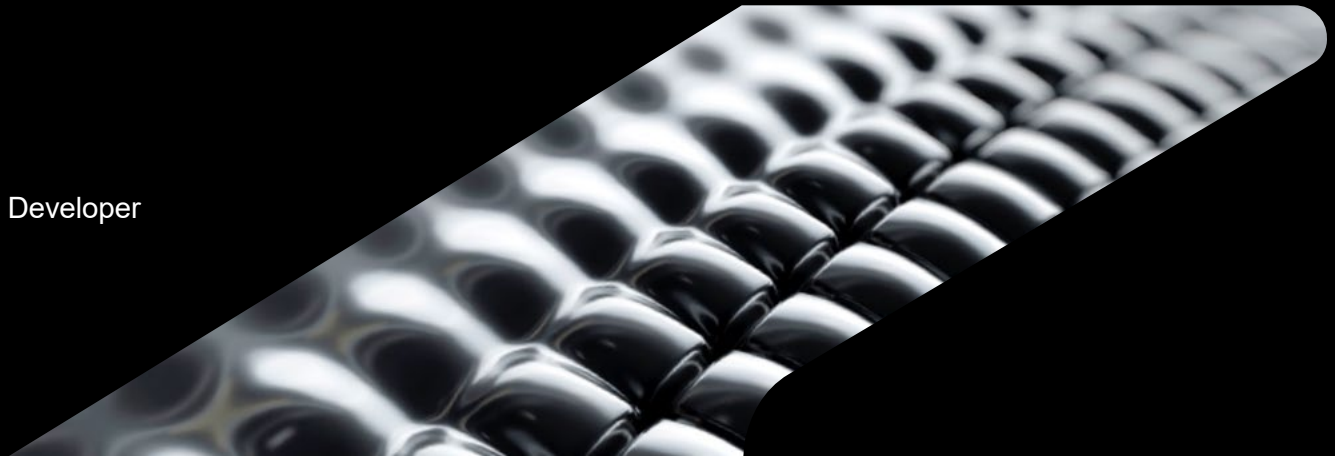
AUTODESK UNIVERSITY

Precast Concrete in Revit BIM Fast in Production

CS502096

Massimo Speziani
Owner of Precast Designer for Revit, Developer

Ilaria Lagazio
Sr. Tech. Sales Specialist Autodesk



Massimo Speziani

He is the owner of “Precast Designer for Revit” a single tool to design and analyze precast structures. He has a structural engineering background and works as software developer providing Revit, Robot and Forge development services. Massimo holds a Master’s degree in structural engineering from University of Brescia, Italy.

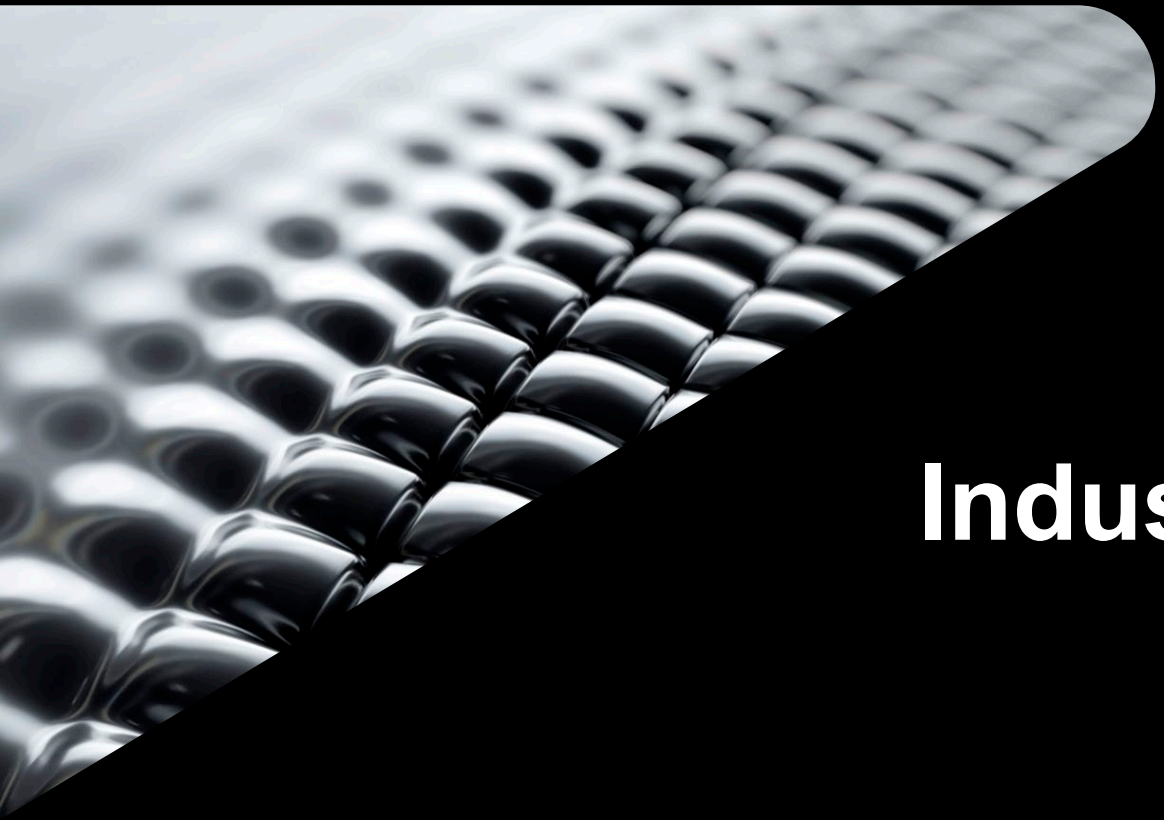
Ilaria Lagazio

After graduation in Structural Engineering at University of Genoa, Ilaria started to operate in construction industrialization as *Building System Development Manager*, focusing on the flow of data from the model to the construction site

This interest for industrialized buildings brought her to a field experience in UAE and then to Autodesk where, with an industry experience of more than 20 years, she covers the role of AEC *Senior Technical Sales Specialist*

Agenda

- Understand precast industry challenges and the potential solution represented by ***Precast Designer*** *for* ***Revit*** for concrete precast
- Key features of ***Precast Designer*** *for* ***Revit*** in terms of Modeling, Documentation and Analysis
- How ***Precast Designer*** *for* ***Revit*** will help saving time and money integrating Revit, Robot Structural Analysis and Bridge Design from the model phase to shop drawing generation
- Flexibility to extend ***Precast Designer*** *for* ***Revit*** to other industries and to production
- AI integration (beta version)

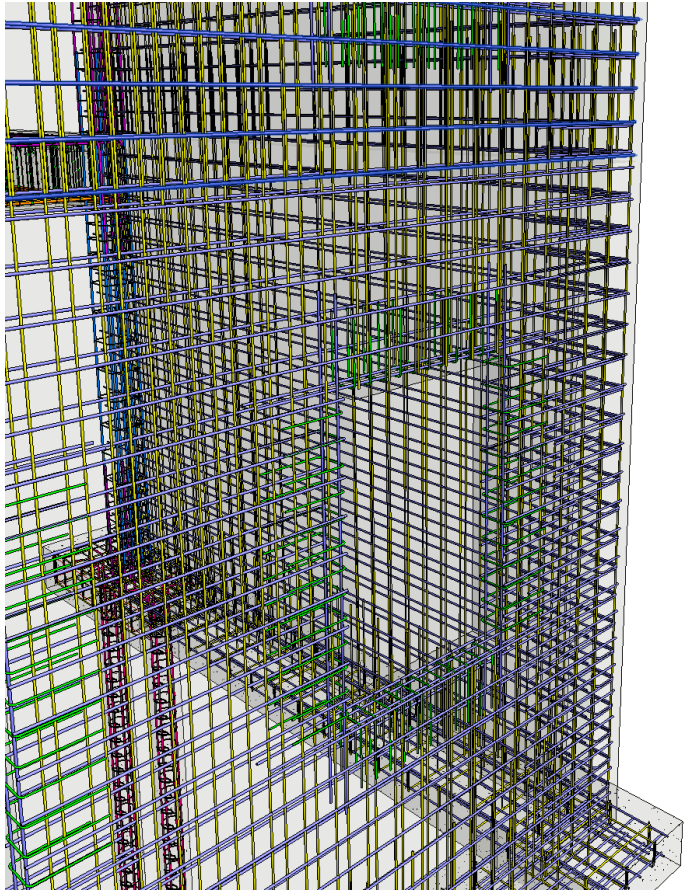


Industry Overview

Structure…Why we care?

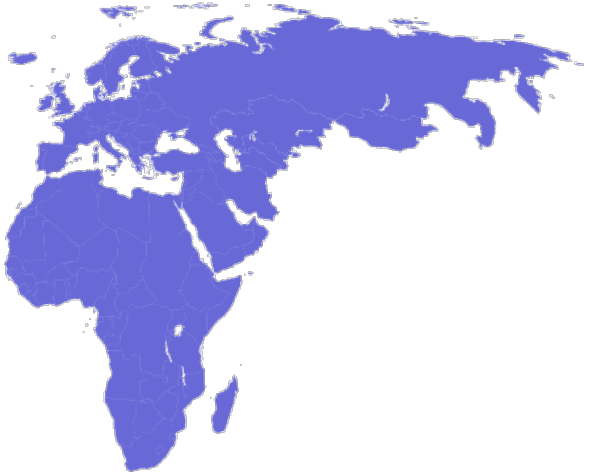
Structure is required to support and transfer loads from building systems therefore is critical part of AEC design and construction…

- A consistent part of costs for construction are for structure
- Structural foundations and frame are **built first** on site therefore is on project critical path
- **Structural prefabrication** is increasing WW, making it a critical part of project delivery



Concrete is a dominant construction material WW

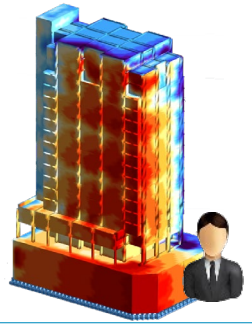
AMER
Cast in Place Concrete 20%
Precast Concrete 10%
Steel 50%



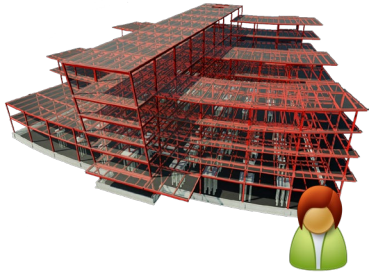
EMEA
Cast in Place Concrete 60%
Precast 15%
Steel 20%

APAC
Cast in Place Concrete 60%
Precast 10%
Steel 10%

Structural Industry Personas

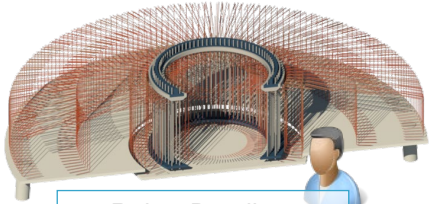


Structural Engineers

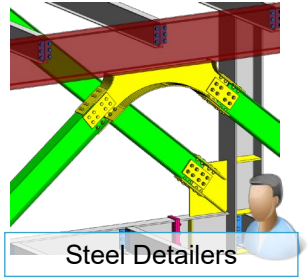


Structural Designers

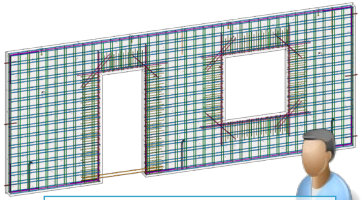
Design (+Detailing)



Rebar Detailers



Steel Detailers



Precast Detailers

Fabricators

Detailing + Fabrication

Current challenges in precast

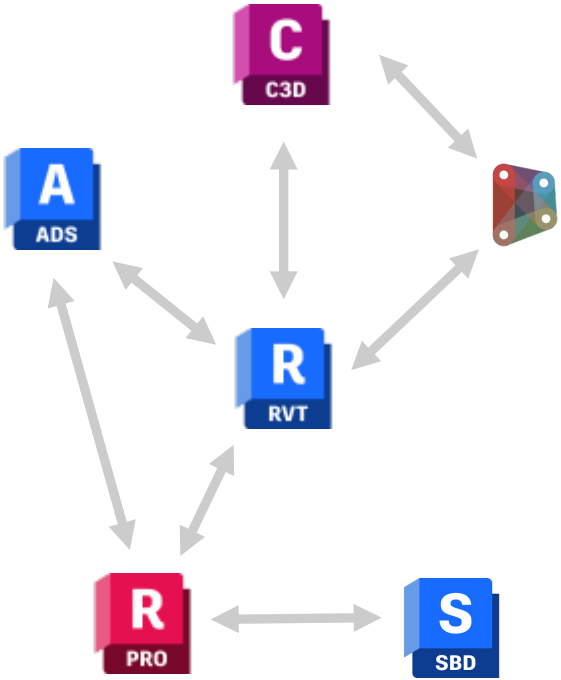
- Material waste and delays on the jobsite
- Increasing project complexity
- Hiring and retaining skilled workforce
- Increase degree of standardization inside the company
- High variability of precast production components
- Design, analysis and production disconnection

Design, analysis and production disconnection

Modeling

Documentation

Analysis



Towards integration

Precast Designer for Revit

Modeling

Documentation

Analysis

RVT

+

Precast Designer for Revit

Key Functionalities

Precast Designer fo Revit

Key Features

Modeling

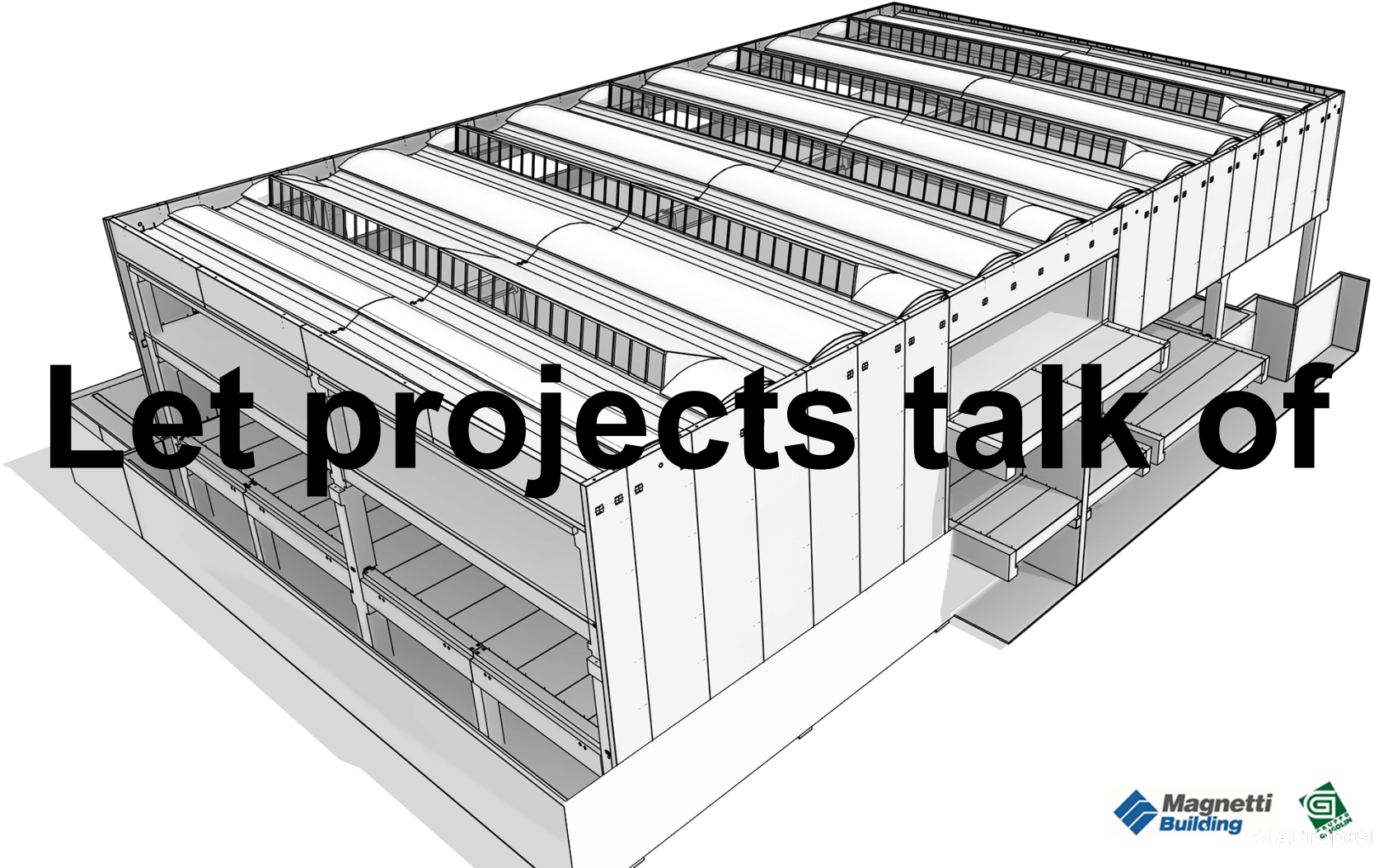
- Automatic Connections between elements
- Construction Tolerance for elements and panels
- Panels construction models
- Rebars and strands modeling directly in family
- Multi-level marking

Documentation

- Automatic shop drawings for every Revit element
- Semi-automatic dimensions for general views
- Bidirectional link with Excel and one directional with Word
- Advanced data management
- Profile view for infrastructures project

Analysis

- Extended Integrated Analysis with Robot Structural Analysis
- Code Checking of Concrete Panels and Members with Structural Bridge Design
- Save Code Checking Results in Revit as Maps
- Customizable Calculation Reports



Let projects talk of it

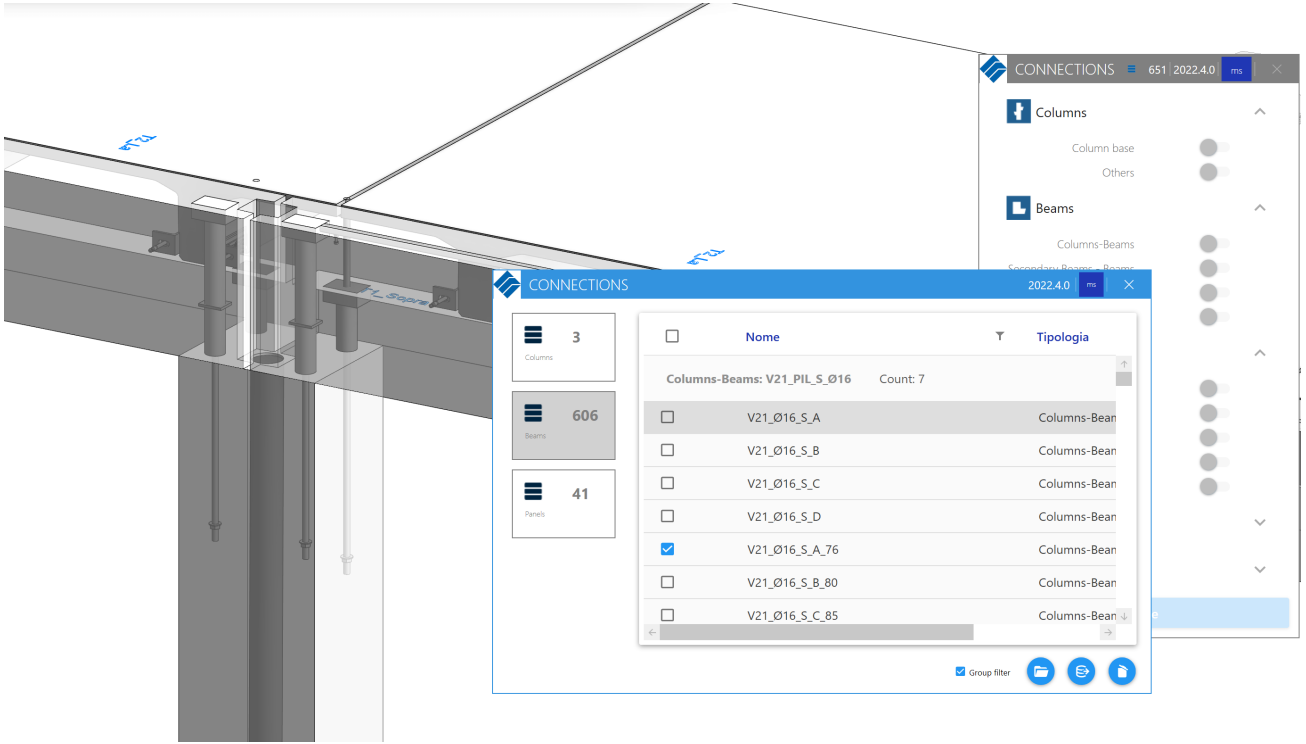
Magnetti Building

AUTODESK UNIVERSITY

AUTODESK UNIVERSITY

Modeling

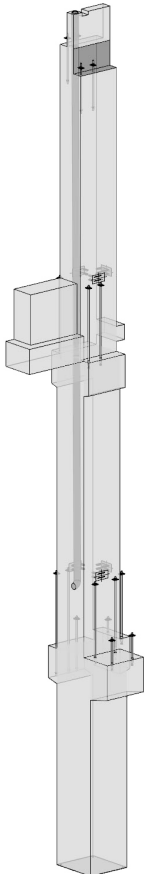
Automatic connections

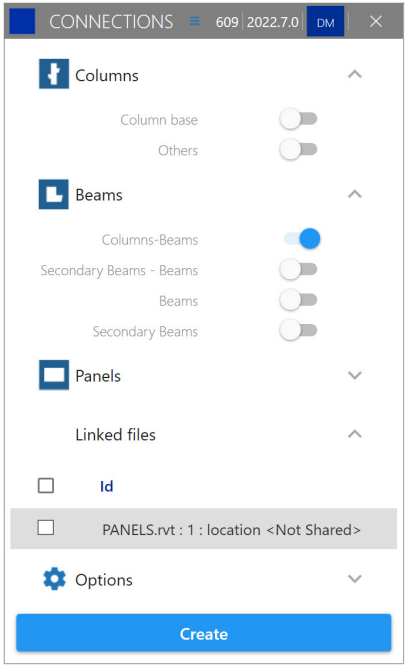


Courtesy of Magnetti Building

Automatic connections

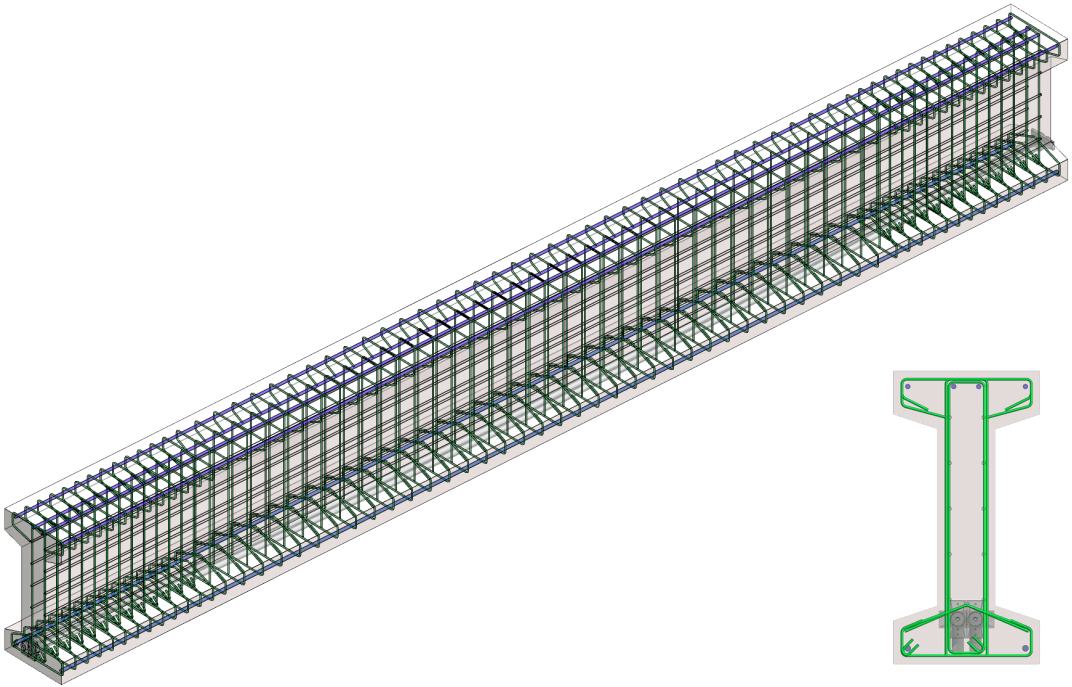
- Create your own generic families and define connection rules
- Create connection in linked model
- Use conditional statement, formulas and geometric information





Courtesy of Magnetti

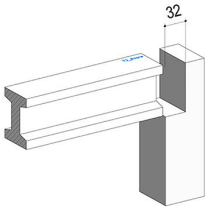
Rebars and Strands



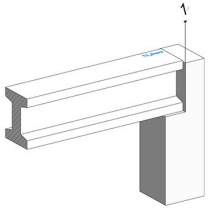
Courtesy of Magnetti Building

Construction Tolerance

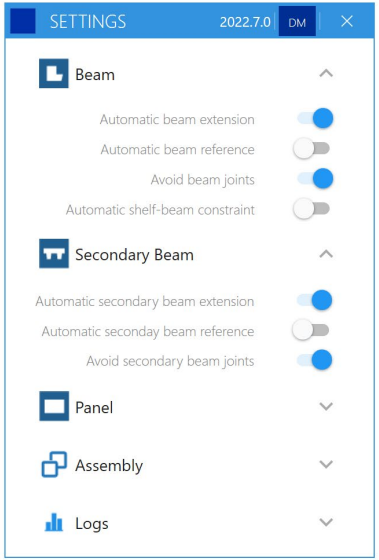
- Automatic tolerance for beams
- Tolerance could be global or based on family
- For every edge of a panel, a different tolerance can be set
- Maintain the architectural model of the panel without tolerances and the construction model in the same files



X



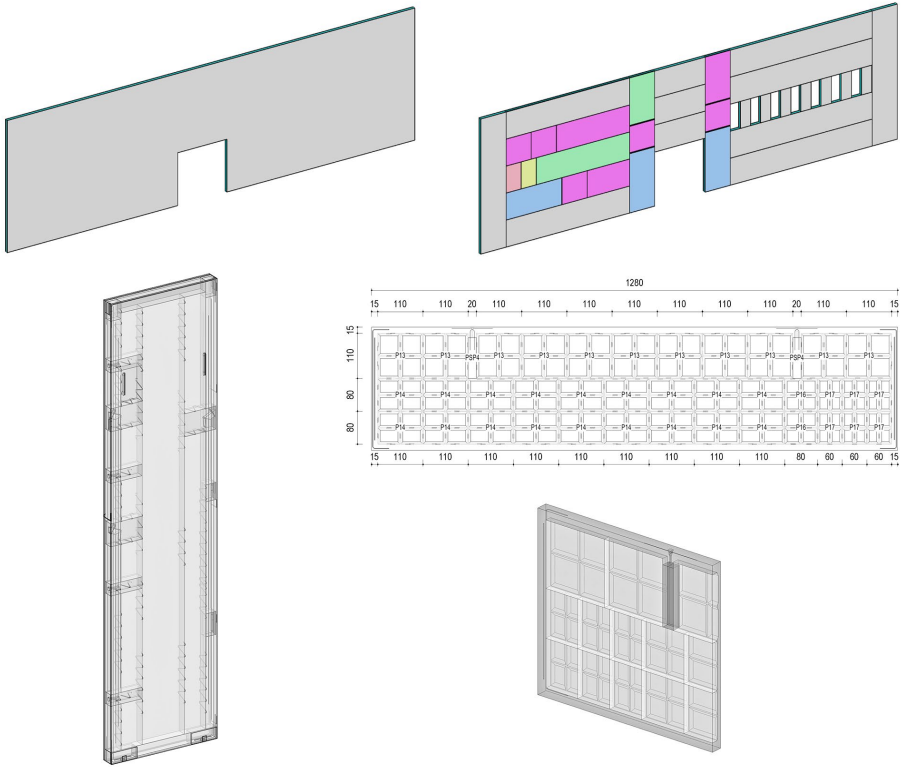
V



Courtesy of Magnetti

Panels

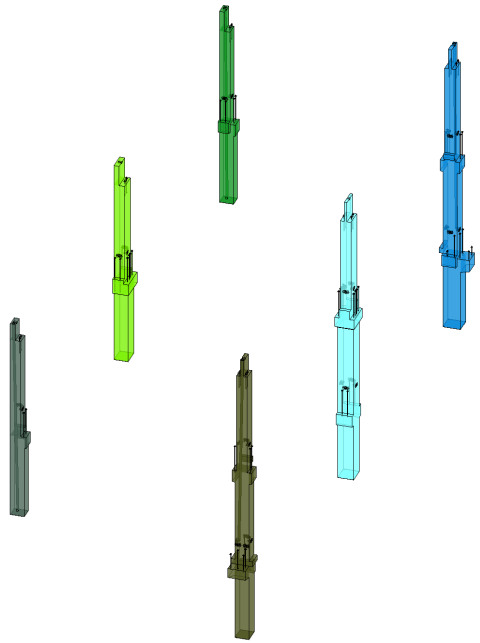
- Segmentation of panels (valid also for slabs)
- Apply different material on the external surface of the panels
- Create the construction model using parts
- Bidimensional nesting optimization and different areas rules for placing object inside the panels



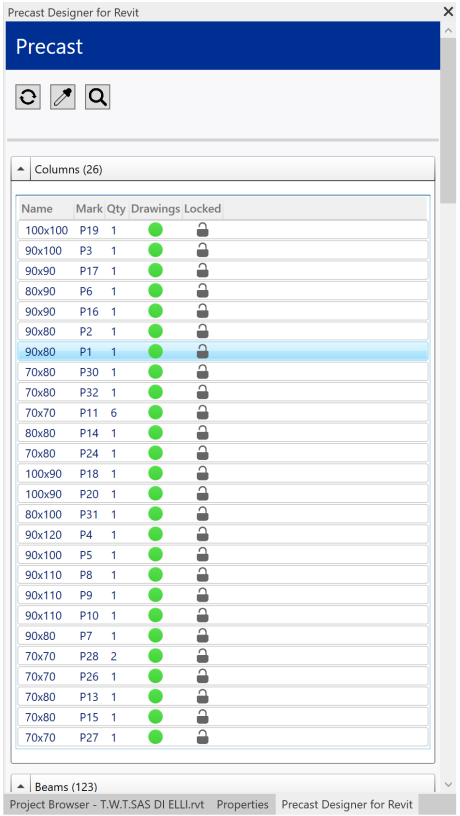
Courtesy of Magnetti

Multi Level Marking

- Define custom rules for numbering elements or panels
- Using tolerance when comparing elements
- Three types of comparers:
  - Geometry comparer
  - Parameter comparer
  - Nested families compares



Courtesy of Magnetti

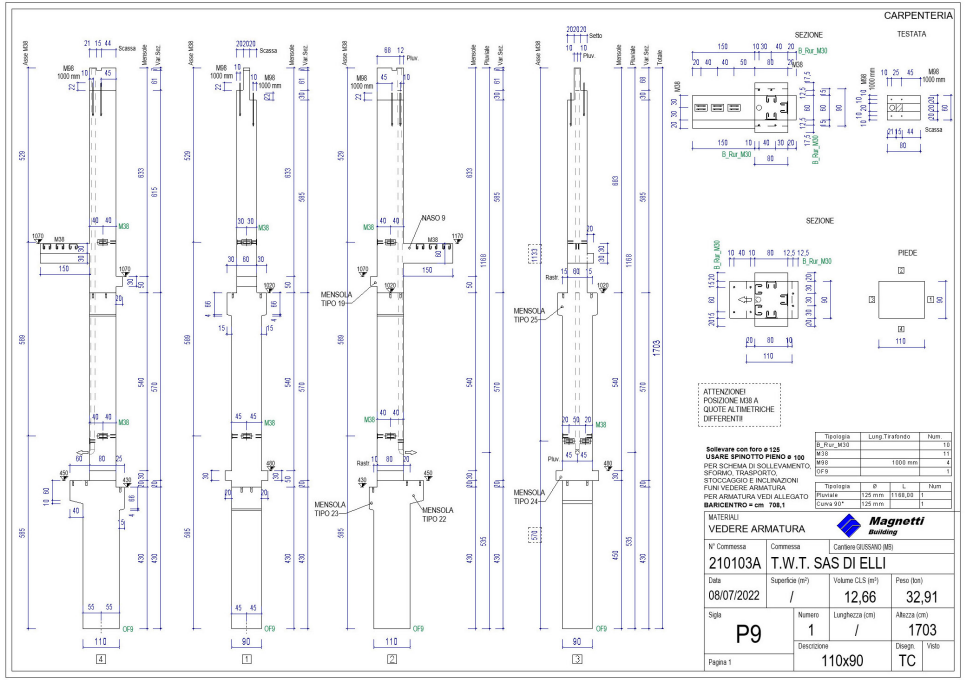


AUTODESK UNIVERSITY

Documentation

Automatic shop drawings 1/2

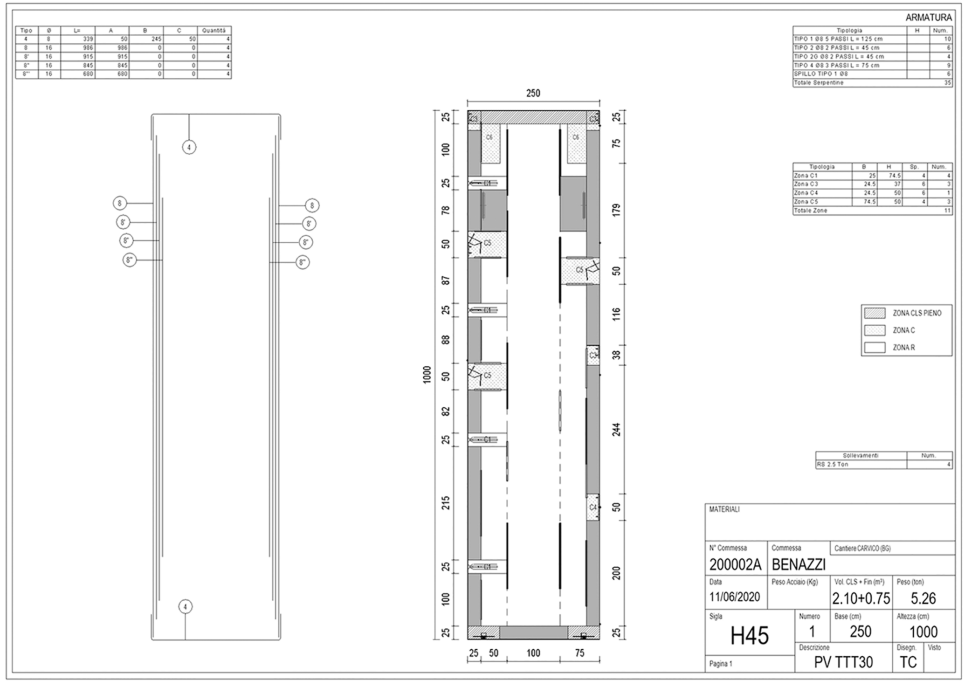
- Generate automatic shop drawings for elements
- Allow to customize drawings according company standard
- Define rules for dimensions, spot elevations, labels
- Set titleblock, sheet and view parameters with rules



Courtesy of Magnetti

Automatic shop drawings 2/2

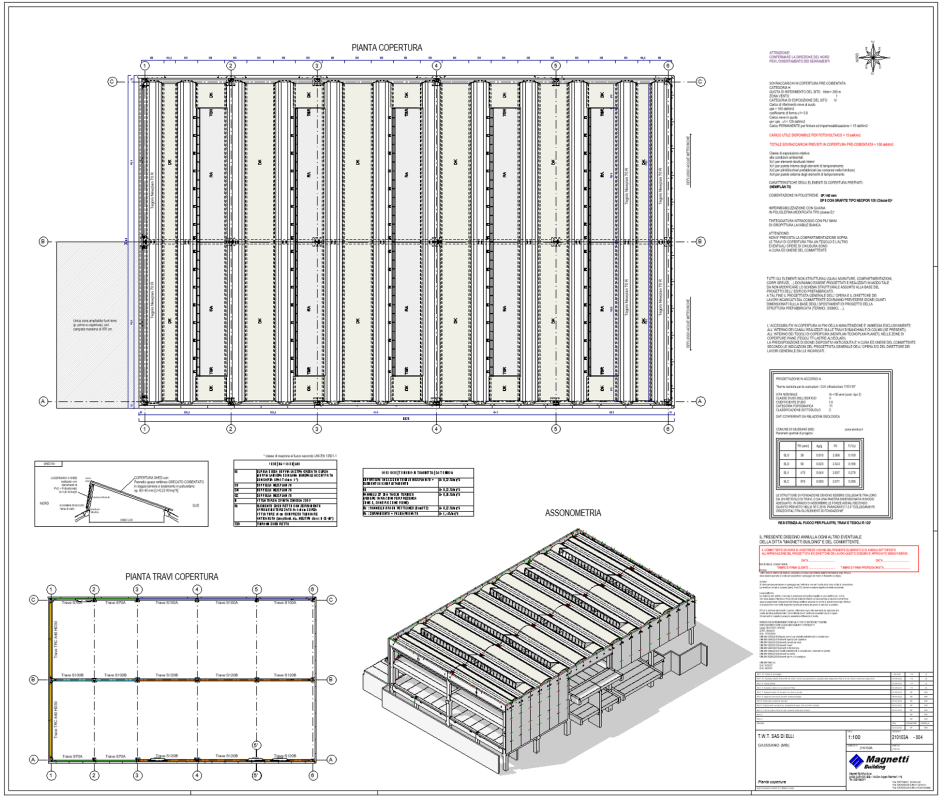
- Apply shop drawings templates with conditional rules
- Create Rules for Rebars pullout
- Place details component and drive through parameters



Courtesy of Magnetti

Dimensions for Views

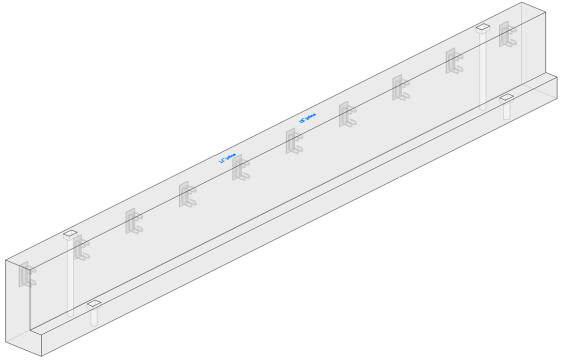
- Place automatically dimension for every type of object in generic view

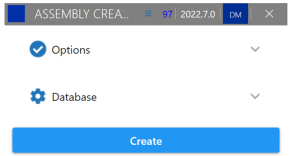


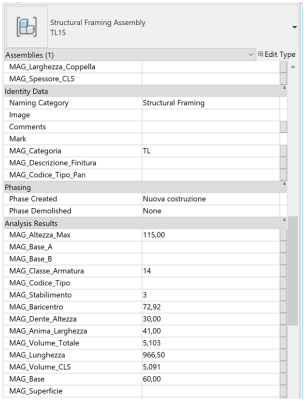
Courtesy of Magnetti

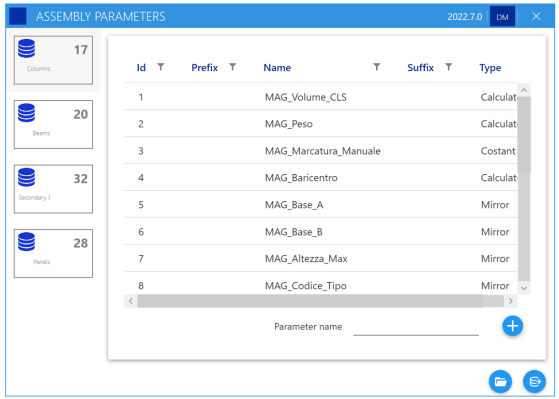
Advanced data management

- Set parameters of element, assembly or sheet using integrated functions
- More than twenty function available, like weight, cog, rebar incidence, interpolation value
- Using formula across parameters of different elements







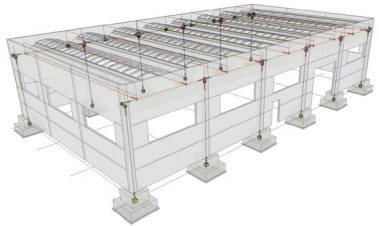


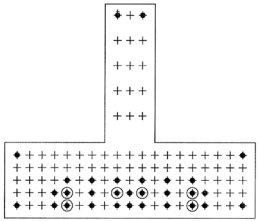
Courtesy of Magnetti

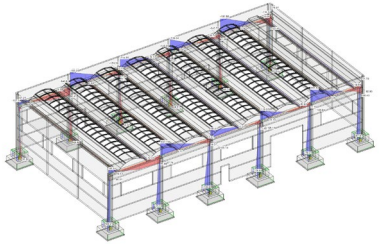
AUTODESK UNIVERSITY

Analysis

Integrated Analysis and Code Checking







Images courtesy of Nicovelo

Revit

Start from Revit. Define elements, base loads and all information necessary for the analysis, like seismic parameters, wind parameters, geotechnical parameters. Generate the rebars or strands

RSA

Generate automatically the calculation model with all combinations. Code checking of steel elements

Bridge Design

Generate automatically SBD models for checking rebars and strands in bars and panels. Real reinforcement in Revit is used and every custom section is translated in SBD using results stored in Revit from RSA

Revit

Get Results in Revit for RSA actions and theoretical reinforcements or steel checking. Get Results of SBD for elements and panel. Calculation reports can be generated and customized in Word and Excel

Integrated Structural Analysis 1/3

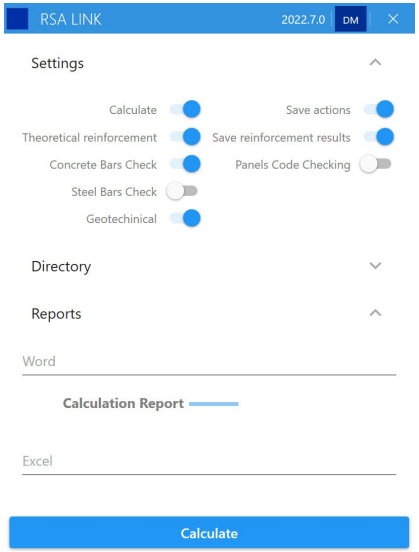
- One single command to send model to Robot, generate load, combinations, reload results in Revit and perform code checking

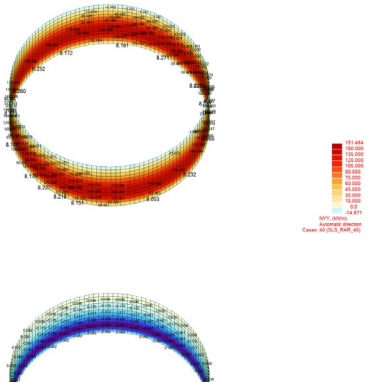
- Automatic generation of Calculation Report from Revit using Revit, RSA and BSD Data

WOLF SYSTEM
Zona Industriale nr. 1
I - 39040 Freienfeld / Campo di Trens (BZ)
Tel. 0472/064000 – Fax 0472/064900
email: mail@wolfsystem.it
Home page: http://www.wolfsystem.it

2.5 Confronto con i risultati del software di calcolo

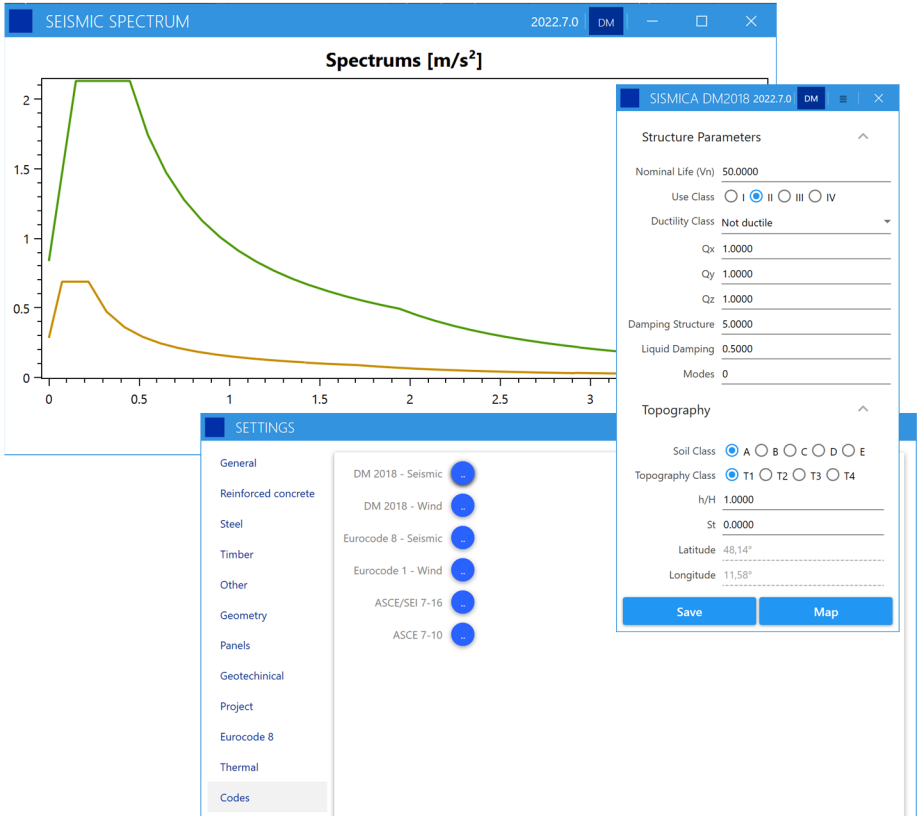
Si riportano di seguito i risultati dell'analisi automatica con software di calcolo; la combinazione di riferimento è la numero 40.





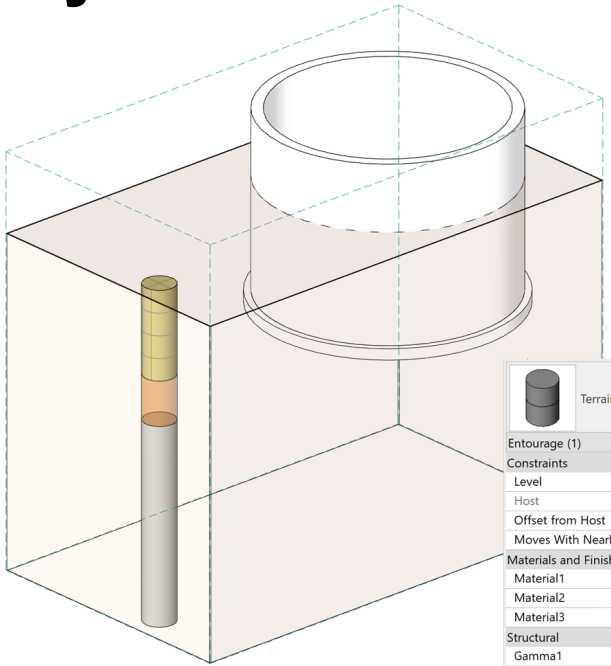
Integrated Structural Analysis 2/3

- Set all analysis parameters in Revit
- Configuration panel for RSA and BSD
- Different codes supported



Integrated Structural Analysis 3/3

- Geotechnical Verification from Revit
- Define the real topography in Revit and the layers of the terrain in order to get the correct load in Robot, static and dynamic
- Layers will also be used for the code cheking of foundations



TerrainStructure

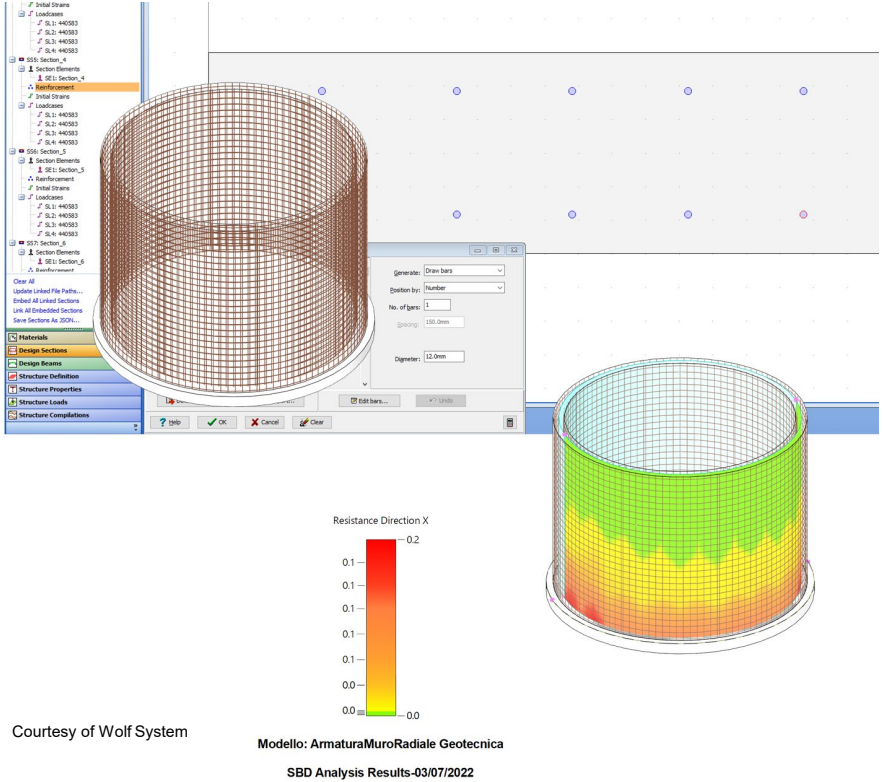
Entourage (1) | Edit Ty

Constraints	
Level	p.c.
Host	Level : p.c.
Offset from Host	0,00 cm
Moves With Nearby Elements	☐
Materials and Finishes	
Material1	Ghiaia
Material2	Geschossdecke (analytisch) - Oberflä...
Material3	<By Category>
Structural	
Gamma1	18,00 kN/m³
Gamma2	19,00 kN/m³
Gamma3	17,00 kN/m³
GammaSat1	20,00 kN/m³
GammaSat2	21,00 kN/m³
GammaSat3	22,00 kN/m³
Dimensions	
Angolo attrito terreno fondazione1	11,00°
Angolo attrito terreno fondazione2	12,00°
Angolo attrito terreno fondazione3	16,00°
Fi1	22,00°
Fi2	26,00°

Courtesy of Wolf System

Automatic Code Checking in Revit

- Check Automatically real rebars in Revit using Structural Bridge Design
- Saving results of verifications in Revit as maps
- Apply different style for element based on conditions



Courtesy of Wolf System

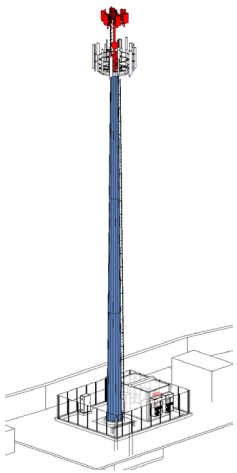
What’s Next?

Steel & Wood Prefab - Artificial Intelligence

Not only Precast Concrete

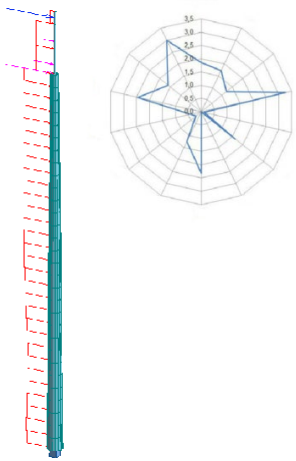
Telecommunication Towers

Integrated Analysis and code checking also for steel and timber

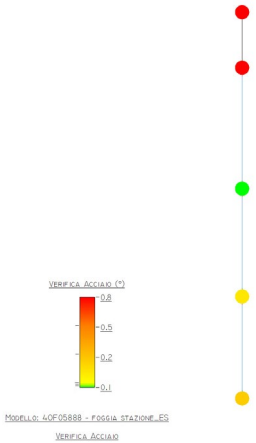


Read all data from Revit like antenna properties

Courtesy of A2F INGEGNERIA S.R.L. – Rome, Italy



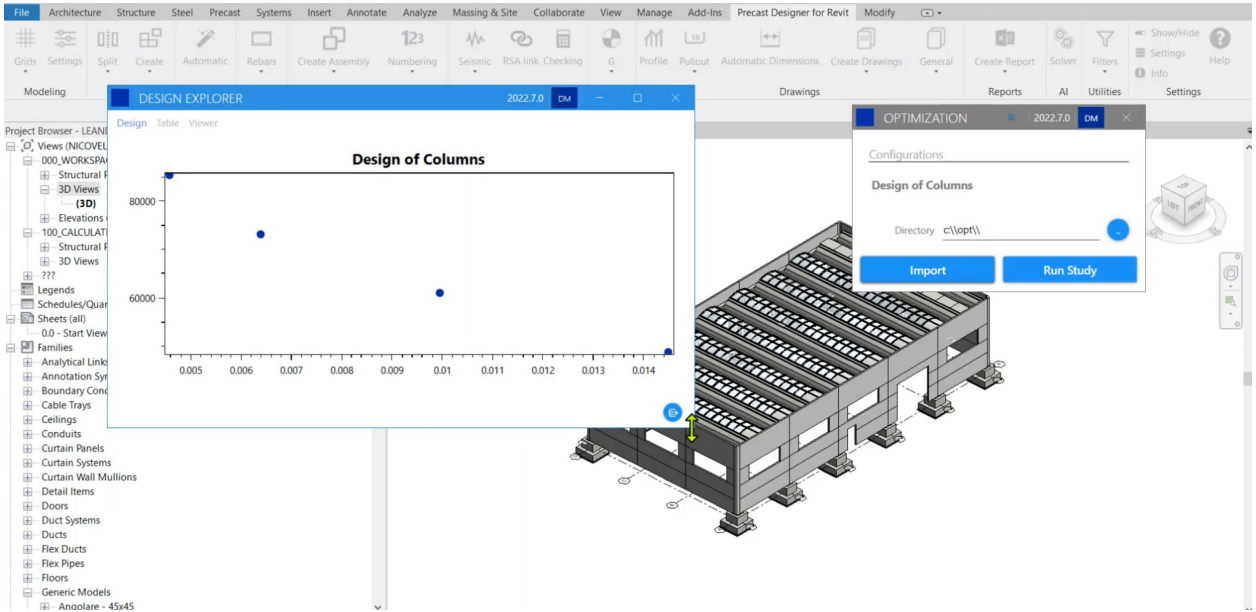
Create automatically the Robot model and all the loads. Find worst direction for wind



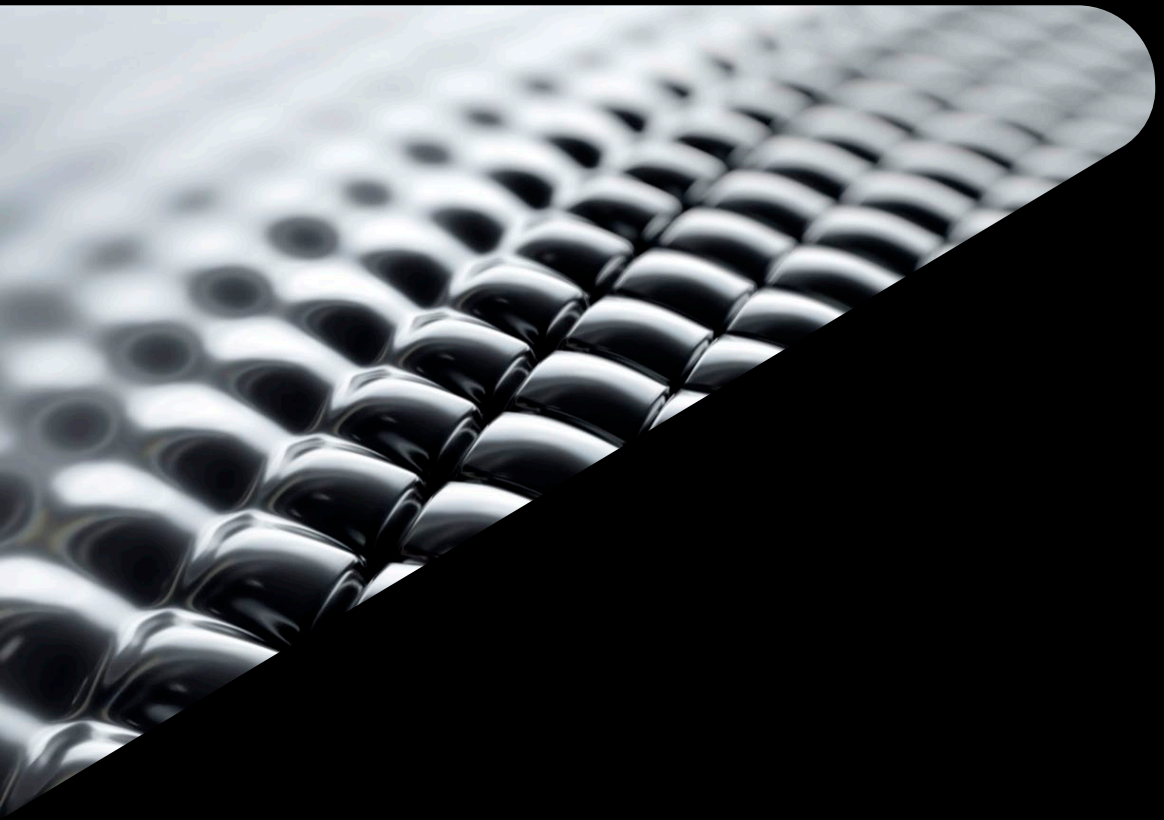
Code checking results in Revit and report generation

Generative Design

How to reduce cost with AI?



Images courtesy of Nicovelo



Conclusions

ROI and Customer feedback

Customers Experience

Previous solution:
Autocad + Robot Structural Analysis standalone

Objective:
Get more flexibility in terms of rebars drawing (curved walls)

Next steps:
Application of AI to the process

Previous solution:
Autocad + Strauss

Objective:
Get connection between calculation and modeling

Next steps:
Still in implementation phase

Previous solution:
Autocad + Robot Structural Analysis + Idea Statica

Objective:
Get connection between calculation and modeling – implementing automatically Robot model with all the loads

Next steps:
Optimize steel connections integration

General saving: up to 70% of TIME from modeling to detailing

Customer Testimonial

"Market requests are more and more detailed and specific: it is not possible to rely on standard solutions as it was in the past.
*With **Autodesk Revit** and "**Precast Designer** for **Revit**" we can analyze details in a tridimensional environment related to any kind of requests, **from modeling to production.***
*This process allows us saving a huge amount of **time**, **money** and most of all increasing **quality** of our solutions"*

Roberto Volpi
Engineer & PM in Magnetti Building

Special Thanks for the support in testing and improving the software

Cristina Togni
Bim specialist in Magnetti Building

Stefano Pocchia
Bim Manager in Magnetti Building

Magnetti Building creates made-to-order buildings with industrialised building systems.
By using pre-finished elements that do not require any additional work to be carried out on-site, binding, faster and controllable timeframes can be guaranteed.
Basic elements, panels, roofs, portals, projecting roofs, corner pieces and shutters can be readily customised, up to the production of unique items in terms of shape, finishes and colours. The construction quality and durability of the materials make it possible to create responsible, sustainable, anti-seismic, comfortable and weatherproof buildings.

LOGISTICS

PRODUCTION

SALES

TERTIARY

INNOVATIVE ARCHITECTURE

REDEVELOPMENT & MANTENANCE

Thanks!

AUTODESK UNIVERSITY

Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product and services offerings, and specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

© 2022 Autodesk. All rights reserved.