AS500213

Moving Toward the Future of Design with Generative Design in Revit

Lilli Smith
Autodesk

Esra Abumounshar
Stantec

Elisa Ambrassa
ENEL

Sean Fruin
Sigma AEC Solutions

Learning Objectives

- Discover the value of Generative Design in Revit
- Learn about three examples of how customers are using generative design
- Learn about the driving principles for future prioritization
- Discover the future direction of the product and the road map

Description

Generative Design in Revit software was released last year for the first time in Revit 2021. This new suite of emerging tools enables generative design workflows that automate the creation and analysis of design options directly in the Revit context. This session will showcase the value that generative design brings to the design process, and demonstrate how analyzing more data-backed design options can lead to an enhanced design process. We will show how customers are using the tools to automate design exploration in their projects to optimize sustainability and efficiency and reduce construction waste. We'll cover the product principles we use to prioritize new work and future directions. Finally, we'll address the future of the product, where we intend to invest, and the road map for achieving our vision.

Speaker(s)



Lilli Smith, AIA, Sr. Product Manager at Autodesk, is an architect with a passion for re-envisioning the way that buildings are designed. After working for several years as an architect, she joined Revit Technology as a fledgling start up and helped grow it to where it is today in almost every architect's tool box. She has gone on to work on many Autodesk tools including Vasari, FormIt, Dynamo, Project Fractal and Project Refinery which recently graduated to a suite of tools for generative design studies in Revit.



Esra Abumounshar is the generative and computational design lead at Stantec. She has been working on adopting computational and generative design tools and implementing them across her company. My work include Healthcare, High Ed, Mixed-use & Master Planning.



Elisa Ambrassa is a Structural Engineer who is curious and passionate about buildings, architecture and innovation. As a BIM Coordinator she works in the BIM Implementation unit of Enel, based in Rome, Italy, where she carries out coordination and automation of wind and solar plants desing and model checkings. She started her career in 2018 at an architecture and engineering office, where she designed structures, buildings and bridges. During my Master Degree she worked in Switzerland applying BIM methodology in the context of seismic vulnerabily of masonry buildings.



Sean Fruin is a Mechanical Engineer (EIT) who has an ardent fascination with automation and the exploration of computational design solutions for the AEC industry. He has had the opportunity to learn many aspects of the design industry, having worked in manufacturing, MEP designing, and General Contracting. Sean started Sigma AEC Solutions, a BIM consulting firm focusing on engineering and process improvement and is living his dream; having the opportunity to explore the latest technologies and acquire the knowledge to innovate, improve efficiency and increase quality in the AEC industry.

Safe Harbor

During the course of this presentation, we may make statements regarding future events and/or statements regarding planned or future development efforts for our existing or new products and services. We wish to caution you that such statements reflect our current expectations, estimates and assumptions based on factors currently known to us and that actual events or results could differ materially. Also, these statements are not intended to be a promise or guarantee of future delivery of products, services or features but merely reflect our current plans, which may change. Purchasing decisions should not be made based upon reliance on these statements. The statements made in this presentation are being made as of the time and date of its live presentation. We do not assume any obligation to update any statements we make to reflect events that occur or circumstances that exist after the date of this presentation.

Autodesk, the Autodesk logo, 3ds Max, BIM 360, Forge, Revit, and other solutions mentioned by name 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.
© 2021 Autodesk, Inc. All rights reserved.

Why Generative Design?

A stunning 40% of global energy is used by our built environment. Buildings alone consume 25% of our water, and building construction produces 30% of all global waste. Architects and engineers as designers of the built environment have a responsibility to take on these issues. Workflows like generative design have the potential to revolutionize the way we design by using goals and measurable outcomes to guide our designs.

Architectural and engineering services have evolved from drawing by hand on paper and delivering it to others to build buildings. Autodesk digitized this process over 40 years ago with the advent of AutoCAD. We've evolved to Building Information Modeling and more efficient ways to deliver building instructions to the field. What we really want to do next is to pair human intelligence with machine intelligence so that we can use data-backed design decisions to create a better built environment.

Over the past few years we've been exploring how generative design can help improve design and construction work. Autodesk Research experimented with generative design workflows to help us better optimize space during our Toronto office renovation a few years ago. We surveyed our employees about their preferences for collaboration, lighting, acoustics, and distance to the kitchen. Then used that data to guide the design. Different floor plan layouts are created and the design process keeps track of the scores for each of the preference metrics. These kind of automated design explorations are not new – generative designers have been using automated techniques for decades, but the have mostly been in the realm of research.

Autodesk's mission is to bring new technology to the market so that more people can use it an participate in the design process. You're all are here today to hear about a new suite of generative design tools first added to Revit 2021 and updated in Revit 2022, and I imagine you want to understand more about what they are and who's using them. You also may be wondering what new tools are under development and what is on our future roadmap. This talk will be split into 3 sections:

1. What's new?
2. How are people using Generative Design?
3. What's next?

1. What's new?

More resources on the generative design tools enhancements in Revit 2022.
https://youtu.be/yv8Kcz1XGBg

More additions in Revit 2022.1
https://youtu.be/LliPUgosPfY

What's new in Dynamo 2.10 (version in Revit 2022)
https://dynamobim.org/dynamo-core-2-10-release/

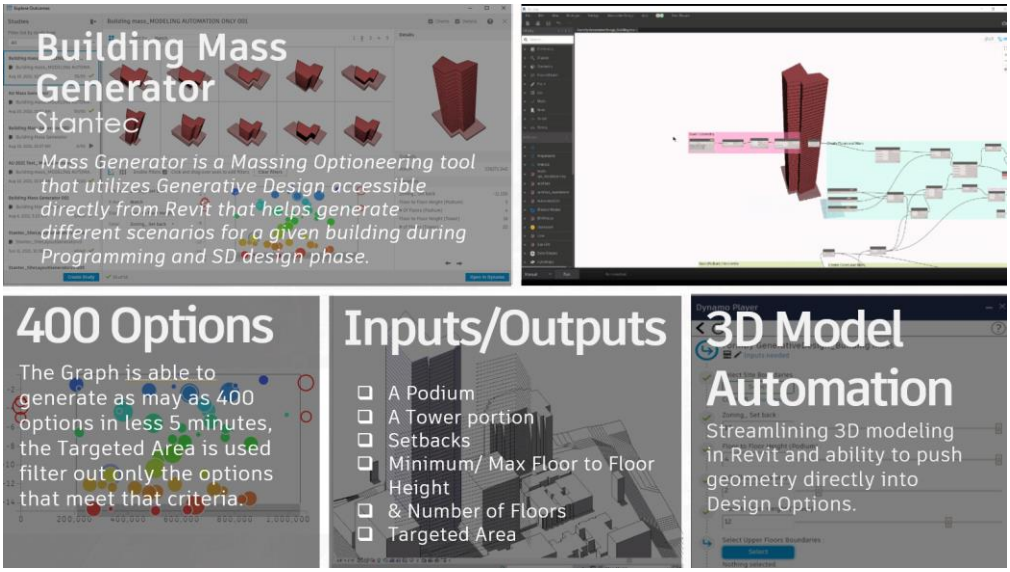
What's new in Dynamo 2.12 (version in Revit 2022.1)
https://dynamobim.org/dynamo-core-2-12-release-part-1-2/
https://dynamobim.org/dynamo-core-2-12-release-part-2-2/

2. How are people using Generative Design?

This section covers three customer use cases. Check out the presentations for more details.

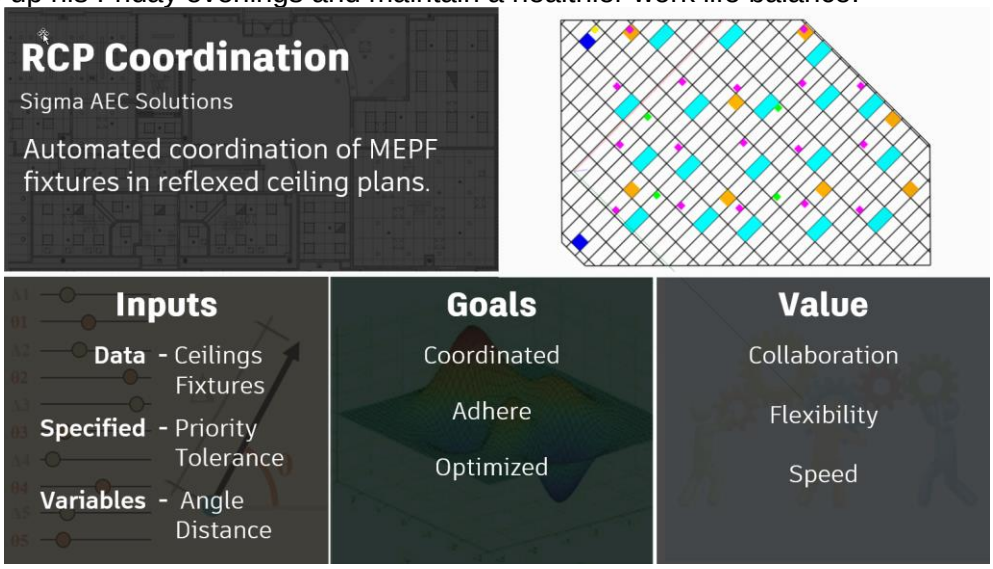
1. Building Mass Generator

Esra Abumounshar, Generative Design Lead at Stantec, will show us a massing workflow where she can evaluate different forms very quickly, keeping track of floor area and pushing the designs back into Revit for further development. She will explain how she enables many members of her team even those not skilled in Dynamo to take advantage of these tools.



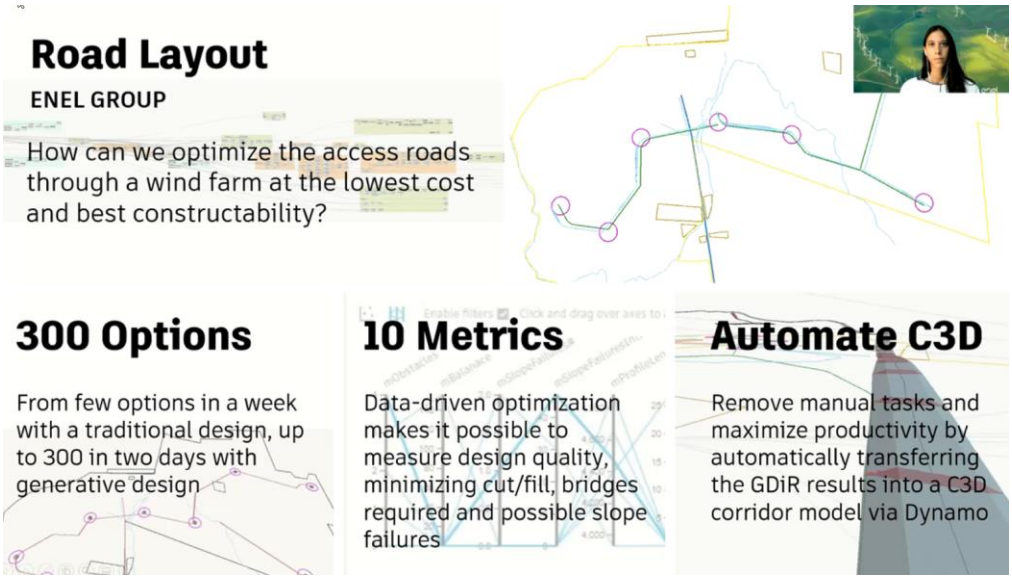
2. RPC Coordination

Sean Fruin, Director of Technology at Sigma AEC Solutions, will show us a workflow he developed to automate the design of reflected ceiling plans so that among other reasons he could free up his Friday evenings and maintain a healthier work life balance.



3. Windfarm Access

Finally, Elisa Ambrassa, BIM Coordinator at Enel Green Power Corporation in Italy, will show us how she uses generative design to lay out access roads in a windfarm. She will explain that because the demand for windfarms is growing so rapidly and their company has so many projects to do, they can no longer design things like these access roads manually - they MUST use automation to design and document them.



3. What's Next?

Here is a brief summary of some of the things are working on for future releases:

1. **Generative Design to Core Dynamo**: We are working on bringing a lot of the functionality that we developed for generative design, like file descriptions and images into Dynamo core. We have always had a Generative Design menu available from Dynamo for Revit, but this move to core will also enable generative design tools to be natively available for all of our dynamo enabled products like Formit, Civil 3D, as well as Dynamo Sandbox.
2. **Dynamo Player Updates:** In recent months, we've seen a big increase in the number of Dynamo Player users as more and more people discover the power of automating parts of their BIM workflows. This warrants making some updates to Dynamo Player. We plan to start by bring a lot of the updates that we've made in the Generative Design in Revit tools into Dynamo Player.
3. **Dynamo UI Updates**: While providing tools to run Generative Design studies directly from Revit is appealing to many users, we find that most of the value of generative design is in customization and being able to run specialized studies for individual design needs. We continue to see an increase in Dynamo use for BIM Automatin and Generative Design. More and more people are investing in learning how to use Dynamo. Therefore, we are investing heavily in improving the tools and giving Dynamo a user interface update, making it easier to express custom logic while making the experience more visually appealing. We've heard a lot of feedback that Dynamo error messages can be annoying and confusing so we're working on making these messages and warnings, more helpful and less in the way. Organizing and annotating Dynamo scripts for use by others is vital when handing off a script. We're enhancing groups with more room for notes, enabling groups within groups, and providing ways to collapse

groups down to just show their inputs and outputs to reduce visual distraction and complexity.

4. **Dynamo Node Auto-Complete** We've heard a lot of people complain that they often get stuck trying to figure out which nodes can feed into others. Node Autocomplete addresses these concerns by providing an applicable list of choices and even presenting the mostly likely nodes first.
5. **More Output Types:** Going back to generative design outcomes, we want to expand the types of outcomes that are available for automated generation. We currently can create numbers and design thumbnails, but it would be really great if we could create more views of a design, assets like excel files, and data in charts to name a few of the possibilities we think would be useful.
6. **Faster Energy Analysis** Autodesk has many analysis tools that we want people to be able to access through whichever design tools they may be using. We are working on ways to speed up energy analysis with machine learning so that energy use intensity metrics can be studied while designing with Generative Design, Dynamo, FormIt, and/or Spacemaker.
7. **Spacemaker Synergies** Spacemaker is a company that we have recently acquired – that is thinking about early stage design problems in a similar way. When you start a design by choosing a site it can imply a whole design space and come up with data backed options that you can compare against eachother. We've already released tools that make generative methods available to communities of designers who have never been able to access these ways of solving problems, and with the Spacemaker acquisition we will continue in similar and even more powerful ways, making customizable tools available for more and more people. Analysis needs to be a pre-emptive part of the design process, to create a close collaboration with our existing customers and our new colleagues in Spacemaker and together building a future of outcome based design

Resources

AU2021 Courses on Generative Design

- Optimize Road Design with Dynamo for Civil 3D and Generative Design (CES500103)
- Generative Design Using Dynamo for Multifamily Residential (AS500109)
- HVAC System Selection with Generative Design (AS500212)
- Two Weeks to Four Hours: How Populous Built Efficiency with Generative Design (AS500272)

AU2020 Courses on Generative Design

- Generative Design in Revit for Workspace Layout - Tomasz Fudala
- Non-Geeks Guide to Optimizing Daily Workflows with Generative Design - Raquel Bascones Recio
- Using Generative Design and Machine Learning for Faster Analysis Feedback - Varvara Toulkeridou
- Generative Design at Hogwarts: Using Tech Instead of Magic - Jacob Small
- Generative Design für Revit in der Praxis - Lejla Secerbegovic
- Diseño Generativo en Revit para todos los públicos - Raquel Bascones Recio
- Generative Design—Daylighting and CFD: A Practical Application for a Nonprofit - Luc Wing
- Generative Design of Landforms with Dynamo in Civil 3D - Andreas Luka

Past Years Autodesk University Courses on Generative Design and Project Refinery

- Geometry Systems for AEC Generative Design: Codify Design Intents into the Machine
- MEP Explore: Generative Design for MEP Designers
- Getting Started with Generative Design for AEC
- Using Generative Design in Construction Applications

Dynamo Resources

- Getting Started with Dynamo:
  https://primer.dynamobim.org/
  https://dynamobim.org/learn/
- Dynamo Forum for questions, inspiration:
  https://forum.dynamobim.com/
- Design Script:
  http://designscript.io/DesignScript_user_manual_0.1.pdf
  https://dynamobim.org/wp-content/links/DesignScriptGuide.pdf
  https://github.com/Amoursol/dynamoDesignScript

Generative Design Resources

- Generative Design Primer
  https://www.generativedesign.org/

- Generative Design in Revit Help
- Generative Design general education: https://medium.com/generative-design