

AS501289

## **Iterative concept design with Spacemaker & Revit**

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### **Learning Objectives**

- Demonstrate project setup in Spacemaker
- Iterate design and real-time analyses in Spacemaker
- Push Spacemaker proposals to Revit with the Revit add-in
- Migrate Revit proposals back to Spacemaker for updated analysis

### **Description**

In this session we demonstrate how Spacemaker can be leveraged to quickly kick-off a project and validate design decisions. Saving you time and effort, we will demonstrate the ideal workflow to combine the strengths of Spacemaker and Revit. From project setup and validating concept proposals using Spacemaker's user friendly analysis tools, we will give you a thorough beginner's guide to get you started in the software. We will wrap up the session with a demo of the Revit add-in used to easily migrate your proposals to Revit for further design development. Need to tweak your proposals? No problem! We will also show how to migrate your proposal back into Spacemaker for further analysis.

### **Speaker(s)**

#### **Caoimhe Loftus**

Caoimhe is Regional Lead at CallisonRTKL's Digital Group, where she combines her experience as a practicing architect and her passion for innovation to demonstrate how technology can improve the way we work. She contributes to internal optimization and automation efforts, including the Dynamo Script Library, new software adoption and Computational Design training.

#### **Arne Bassøe-Eriksen**

Arne is a Customer Success Manager in Autodesk specialized in Spacemaker. He is trained as an architect but works to get Spacemaker into the hands of as many buildings professionals as possible. This entails introducing, training, and aiding the users of Spacemaker to get the most out of the software so get the most value.

## Introduction

In this session we explore the ideal workflow at concept design stage using both Spacemaker and Revit. We recommend starting your project in Spacemaker for project creation in an environment designed for early-stage massing studies and analysis.

The Spacemaker Add-in for Revit facilitates interoperability between Spacemaker and Revit. Proposals can be imported as either generic models or prepopulated with walls, floors, and roofs. This workflow means you do not need to repeat work you have already done in multiple software. You can switch between Spacemaker and Revit when more detailed option studies or additional analysis is required.

Another advantage of starting your design proposal in Spacemaker is that when import your proposals in Revit, project coordinates are automatically set up for you. Where context information is available in Spacemaker you can imported it to your Revit file.

We will cover:

- Spacemaker as a product
- Project Setup in Spacemaker
- Iterate Design and Real-time analyses in Spacemaker
- Push Spacemaker proposals to Revit with the Revit add-in
- Migrate Revit proposals back to Spacemaker for updated analysis

## Note

As a web-based platform, Spacemaker is updated frequently, there is a risk that some of the workflows we describe below may be updated by the time you review this document.

## Spacemaker as a product

Spacemaker is a cloud-based AI software, empowering teams to collaborate, analyze and design real estate sites. From feasibility to site acquisition, Spacemaker empowers you to make confident data and insight-driven decisions, design faster and smarter, and create high-quality, high-value sites. It is a Software as a Service, and has four main facets:

### Automated data

Spacemaker lets users automatically create a 3D representation of a site and the world around it, fetching data automatically (terrain, existing/adjacent buildings, roads, and rails including noise, property data etc). And it does it fast; rather than spending a day or two setting this up, it happens in seconds/a few minutes. Then it lets you easily put in place necessary constraints, giving you a strong starting point for working on a site.

### AI-powered design AU

You can explore and test feasible strategies to develop a site. Spacemaker allows you to draw proposals as you were doing it by hand, or let our AI generate solutions based on the site and the constraints that have been set. You can also import existing proposals (from e.g Revit or Rhino) into Spacemaker. The goal is for you to explore more strategies and concepts in a way that traditional tools do not allow.

### Real-time analysis

Spacemaker allows you to do outcome driven design. Simulate and predict the impact of your proposals with detailed and accurate analyses of 100+ decisive criteria and constraints in real-time, incl. geometry, outdoor area, sunlight, noise, wind, daylight, view, microclimate, and more.

### Collaboration

Work with the entire planning team and regulators in ONE platform on the same digital models. We strongly believe in the power of collaboration and allowing architects, real-estate developers, project managers, engineers, and even planning authorities to collaborate closely as a team, with a fact-based dialogue.

### Use-cases

Here is a brief overview of what our platform is used for by our customers:

**Site acquisition:** Spacemaker allows you to understand, screen and evaluate many sites in a short amount of time.

**Project or site development:** You can reach the optimal utilization of a site, with the best possible living qualities.

**Dialogue with planning authorities:** The project team can communicate efficiently and fact-based with the regulator, and iterate fast on the feedback, even during meetings.

You can also document how your proposal affects and is affected by neighboring development projects.

## Introduction to Spacemaker

Spacemaker is best experienced by trying it out. The features described in the handout are intuitive but have been described here for your reference. Most of the information included has a reference to Spacemaker's [Help Center](#) that contains great guides and technical documentation on how the analysis are calculated. If you are more of a visual learner, then we have some [free on-demand webinar recordings](#) that shows the flow through the product as well as the recording of the session this hand out belongs to.

To be able to use Spacemaker you will need to hold a license. This can either be acquired by signing up for a **30-day free trial license** or by buying a license. Both can be done through the [Spacemaker product page](#).

Spacemaker is cloud-based software, which means you do not need to install anything as it runs in your internet browser. We suggest using Chrome to get the best experience.

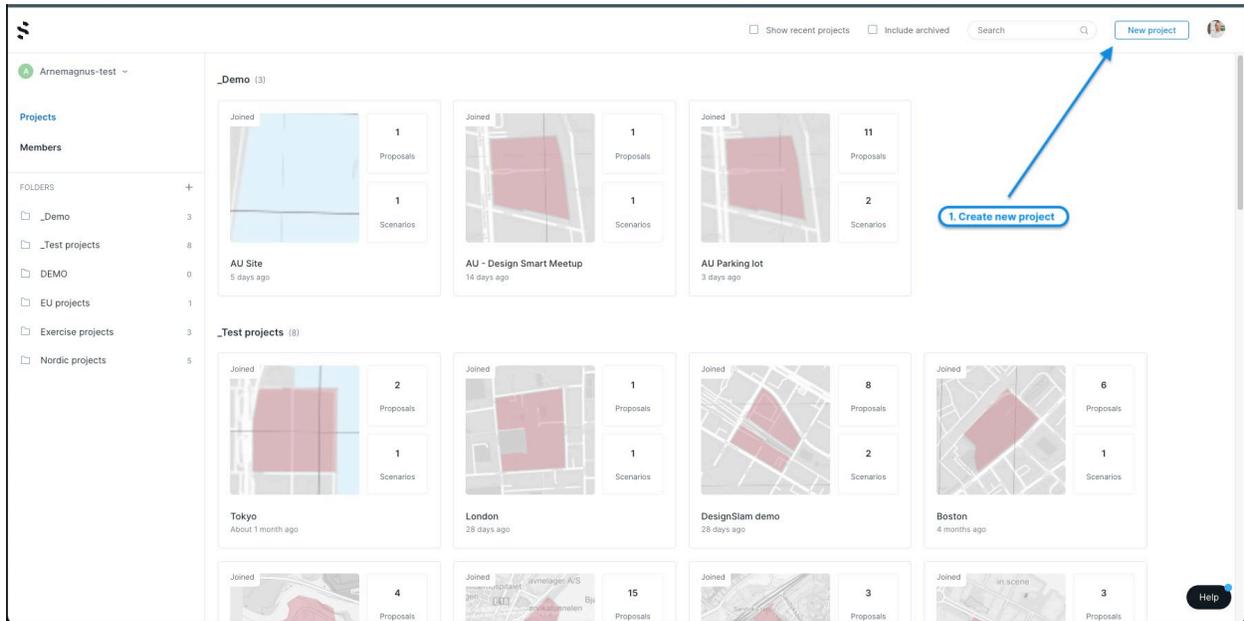
The following sections will introduce you to how to create & set up a new project as well as designing proposals and analyzing their qualities.

## Project Setup in Spacemaker

Creating a project in Spacemaker is done through a short series of steps. Based on the locations of your project, Spacemaker will fetch the available data for the site that we have available. Sometimes the data could be less than what you desire and therefore we will also show you how to import your own data. This is covered under the section on Import.

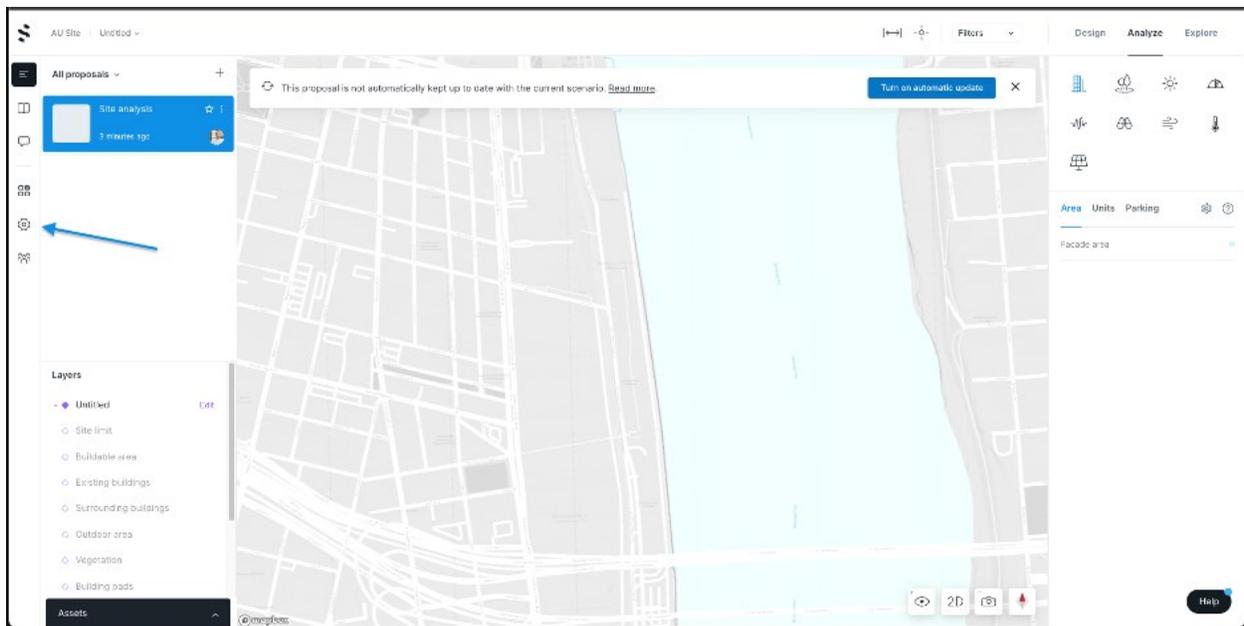
### Creating a new Project

To start a project, simply log into Spacemaker.ai click the **New project** - button in the top right corner and follow the following steps. A detailed step-by-step guide on how to create a project can be found [here](#).



## Project settings

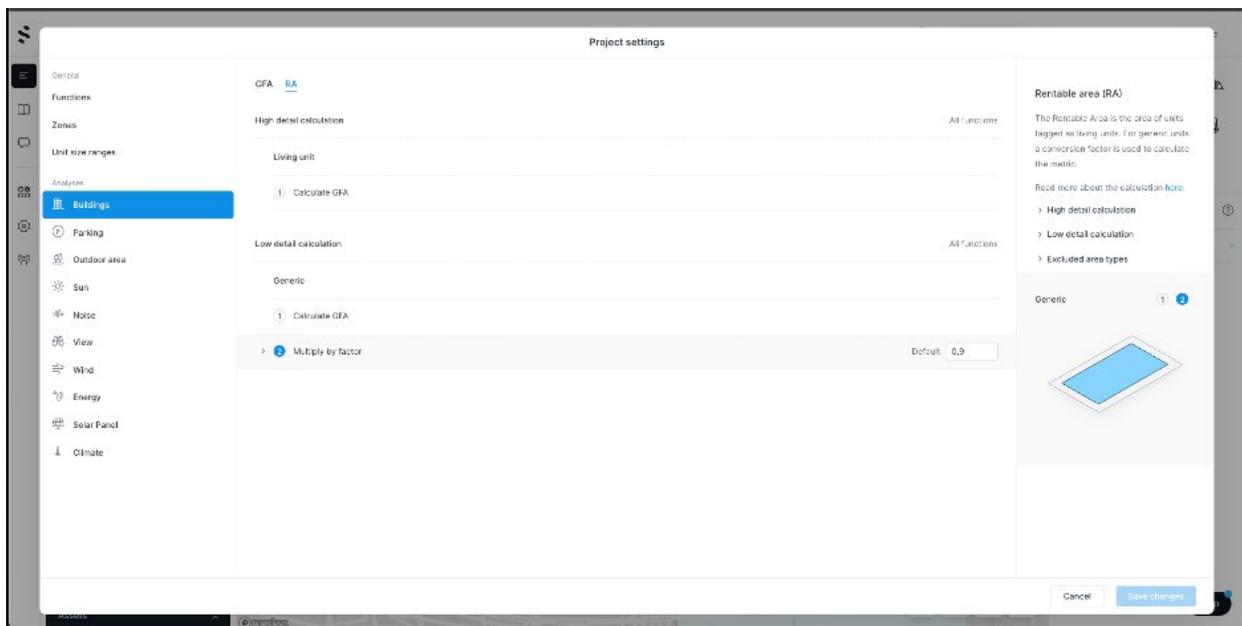
Spacemaker might spend a minute or two fetching the data and assembling your model. The software is helping you to get fast analysis on your sites wherever in the world, but to make the analysis results tailored to your project, I suggest going into the **Project settings** while waiting for the terrain to load and the surrounding buildings to be added.



Start by going into **Functions, Geometry & Sun** as your bare minimum. Note that the changes you do here will affect all your current and future analyses, and thus retrigger any analyses you might have done in the past if you change these settings at a later stage.

**Functions:** Add the functions you would need in your project. Be aware that it matters if you create a function under “Residential” or “Other”. Spacemaker will calculate the areas differently based on what category they are in. You will later in Design be able to allocate these functions to the different buildings, floors, or units.

**Buildings:** Depending on the location of your site, the area calculations that Spacemaker provides will differ. Familiarizing yourself with how we calculate areas for you project by hovering over the various fields and reading the tooltip in the right bar together with looking at the illustration.



**Sun:** I highly suggest adding more dates here as this will help you gain more insights into how your project performs on various dates around the year. Usually, I add the solstice for both the darkest and lightest days of the year, June 21st & December 21st, and the equinox (March 21st). This usually gives an excellent indication of how your project is performing on the darkest, mid, and sunniest day of the year.

// Note // The sun analysis is used in with other analyses: Outdoor area (in some regions), Microclimate, and Solar Power analyses.

When you are done reviewing the settings, then press **Save changes**.

// NOTE // If it is the first time you are using Spacemaker then I suggest you start by familiarizing yourself with the [How to navigate Spacemaker](#) - guide before you start with the next section

## Layers – Adjusting the context of your site

The context of your project is important to getting accurate analyses results. Therefore, the next steps are to edit and enrich your sites contextual information. This can be done by clicking on **Layers > Edit**.



To get the most out of Spacemaker you would need to add a **Site limit** and a **Buildable area**. Those are the two minimums, but I highly suggest also reviewing **Surrounding buildings**, **Existing buildings**, **Roads & Rails**, and **View to area**.

### Site limit

A detailed guide on how to add your site limit can be found [here](#), or if you already have your site limit drawn somewhere else and would like to import it, then you can follow this [guide](#).

// NOTE // The site limit is used by several analyses and is therefore important to add for Spacemaker to work optimally.

### Buildable area

Buildable area is optional to add, but I suggest adding it as this will be used by our **Explore** and **Auto buildings** – functionality to create suggestions for how to place buildings on your site. We will use both in this guide. The easiest way to add this is to copy and paste the site limit.

### Surrounding buildings

Review the surrounding buildings on your site. Depending on the source of the data, the surrounding buildings might lack precision e.g. when heights are unavailable then the volumes will show up as 3 m / ≈9 feet tall, or buildings that step might appear as a single volume. A detailed guide on how to edit the buildings can be found [here](#), alternatively, you can [import](#) existing buildings.

// NOTE // If you would like Spacemaker to analyze the surrounding buildings for your site to assess how your proposal affects the surroundings, then you should select the buildings of interest and tick the “Analyze building”-option in the right panel. Analyze will separate these buildings into a category that can be turned on or off inside each analysis.

### Existing buildings

If your site already contains buildings that you plan to remove, then click on the buildings you wish to remove > right-click > Delete.

### Roads & Rails (optional)

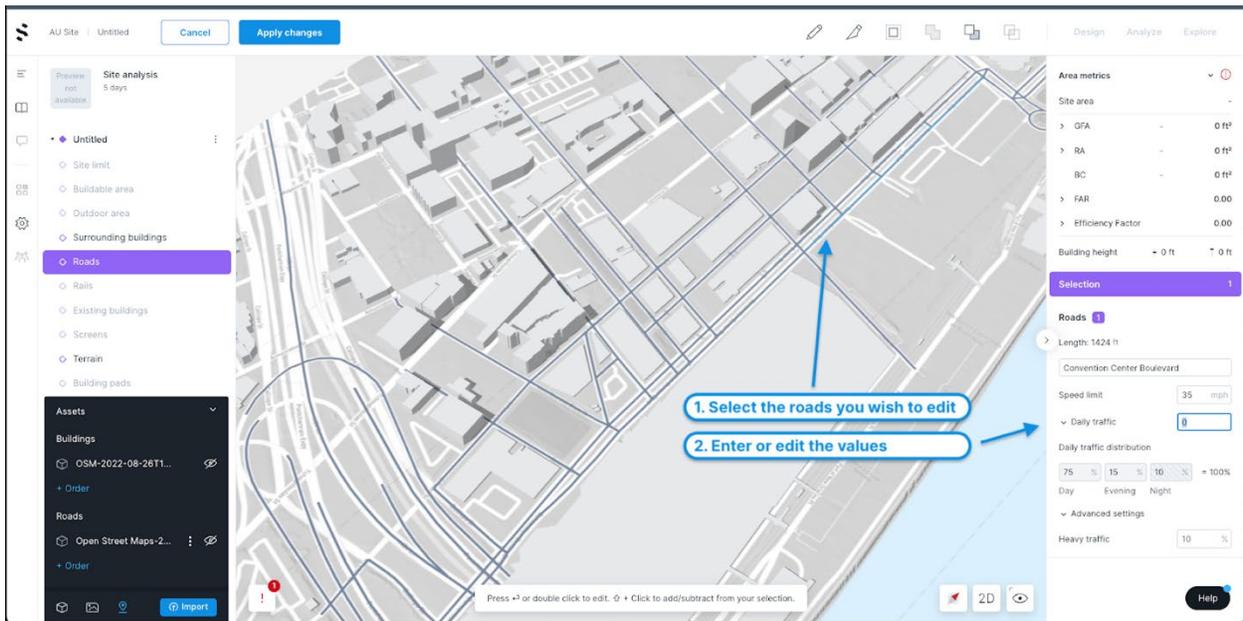
To get a noise analysis in Spacemaker, you will have to add the roads. Spacemaker fetches the road segments with the available metadata from Open Street Map, or a local source if we have that for your site. This means that we have the centerline of the road, its name, and in most cases, its speed limit. If we have a local source for road segments, we might also be able to provide the Daily Traffic on the main streets.

To add roads, follow these steps:

Open **Assets(1)** > **Data orders(2)** > and click the eye(4) behind the road source. Then select the roads(5) by dragging over the desired area. It does not matter if you select more types of elements. In the right panel, you will see a section that says **Assets selection** in black. Then choose the layer you want it to be placed into, “Roads” is the default, and click **Place(6)**. Finish by clicking on the eye(4) again to turn the asset layer off.



In most cases you will need to enrich the road data with the daily traffic numbers to get the noise analysis. To do this click on the road segments you wish to edit > and change the values in the right column. To edit more roads at once, hold down shift while clicking on the road segments, or drag over the roads to select a few at the same time.



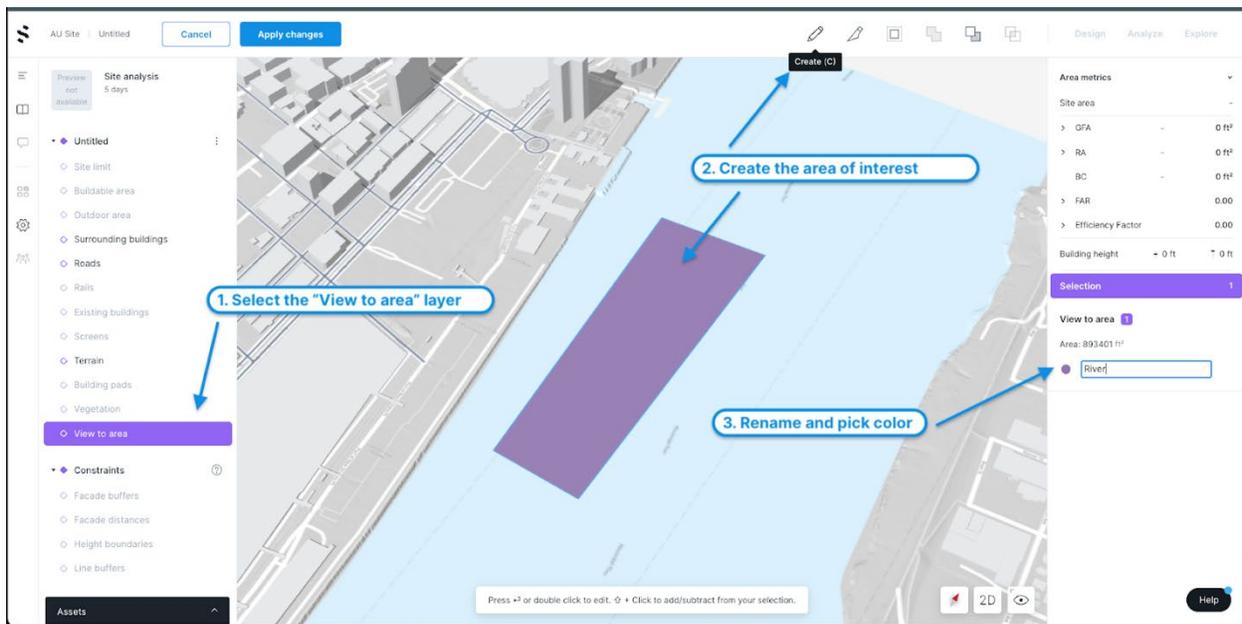
// NOTE // If you get a “geometry validation warning” (bottom left corner, red !-icon) that some of your geometry is outside of your map area, then you should click on the symbol and then the message and it will preview where that geometry is. Either delete the geometry entirely or select it and use the **Split**-tool. The split tool works by clicking on one side of the lines you would like to split and then click again on the other side to make a line that “cuts” through it, making the road segment into two lines. Finish the tool by pressing Enter or clicking again on the last point. Then select the lines that go outside of the map area and delete them.

To add railways (train, subway, tram), then you need to click on the **Rails** layer in the left panel and draw the line segments yourself by using the **Create (c)** tool and then add the metadata for it in the right panel.

### View to area (optional)

For Spacemaker to be able to analyze an area of interest you will need to define that for us. This can either be imported the same way as the site limit, or its often easier to just draw it yourself.

Click on the **View to area** - layer in the left panel to be able to create the geometry on that layer. Then use the **Create** tool to draw a polygon on interest. Finally, give the polygon a name and color.



// NOTE // Spacemaker currently only supports areas that are on the ground surface, meaning that it will not analyze e.g. a building or a forest. Hack: To be able to analyze a building then copy the building into the **Building pads** layer and give it the correct height. Then draw an area around it in **View to area**. This will then alter the terrain to mimic the building and then we can analyze the “building”.

### Finish setting up your project

To finish setting up your project and adding all the relevant surrounding information that you have added, click **Apply changes** in the top bar, and click **Apply** in the window that opens. You can always go back and edit the layers.

You are now ready to start designing your first proposal!

## Iterate design and real-time analyses in Spacemaker

This section will be split into two parts: “Design your proposal” and ”Analyze”.

### Design your proposal

Now that you have set up your project it is time to start designing! Spacemaker consists of three modes, **Design, Analyze & Explore**.

**Design:** Access this mode by clicking on the Design in the top right corner. This mode is all about placing buildings on your site. In this mode, you can use several different tools to create and edit buildings to end up with proposals to analyze.

**Analyze:** This is where you can look for more insights into your proposal. You will be able to discover the qualities and challenges of your concepts.

**Explore:** This mode will help you explore alternatives for either the heights of the buildings that you have already placed on your site, or it can suggest layouts for buildings on your site. This will help you with a good starting point, before you can then customize the solution to fit your site the best.

In this first part, we will be using **Design & Explore** together to create our first proposals. In the [Design section](#) of our Help Center, you will find many great short instructional articles on how to use the tools inside Design, so I will therefore not cover all tools in detail.

## Creating your first proposal

Let us start by going into the **Design mode** (top right corner) and adding buildings to our site. As we enter **Design** you will see that we have some **tools(1)** available to us in the top bar, our **proposal list(2)** in the left panel over **Layers(3)**, and in the right panel we have **Rapid analyses(4)** (Area metrics, Sun, Noise, Wind, Operational energy, and Constraints) and **contextual options(5)** for what you have selected and working on.

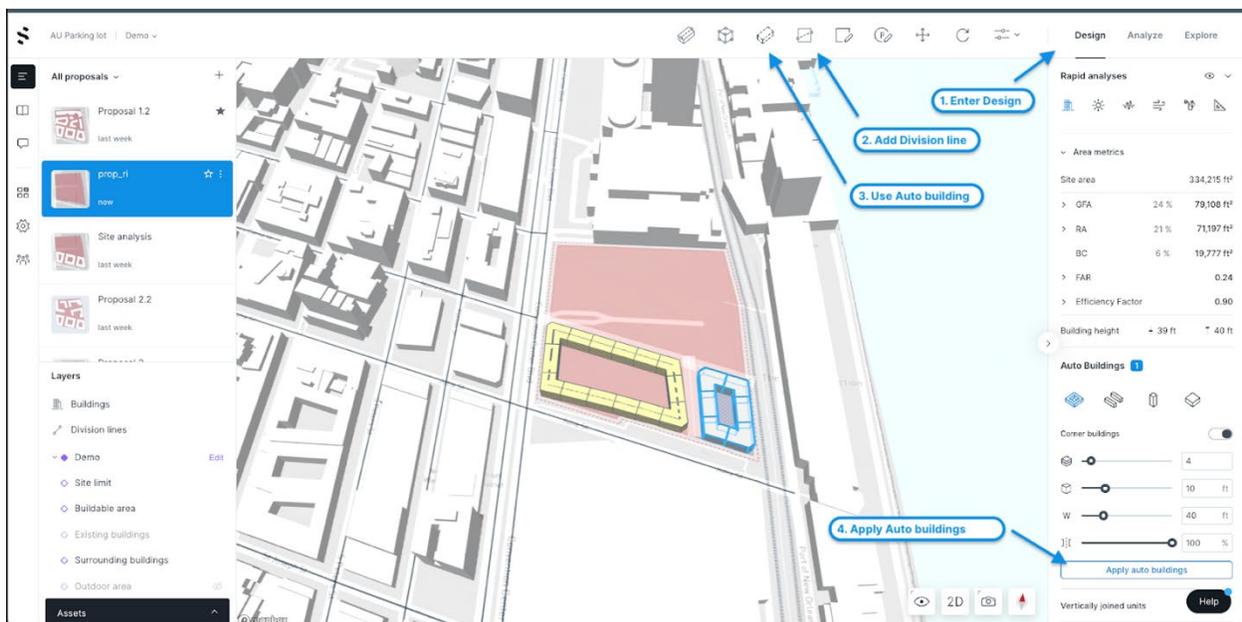


## Using Division lines and Auto buildings to create a proposal

Often there are existing roads or paths that need to be maintained or used when designing. Therefore, I like to start adding [division lines](#) (shortcut: “s”) so I can see where I can place buildings for the rest of the site. [Auto buildings](#) is a fast way to fill the areas between the division lines that you have created.

### Instruction:

- Click on **Division line (2)** and draw a line by clicking where you want it to start and then click again to end. Tip: hold down the *shift* key if you want to continue making connected division lines.
- Click on **Auto buildings (3)** and click on a place on your site to apply this tool
  - Select the area and change the parameters of the generated volumes in the left panel.
  - Move a division line or create a new one to see that the building adapts to your changes.
  - Click **“Apply auto building(4)”** to apply it to your site for further editing



## Editing and creating buildings by using Line edited buildings

[Line edited buildings](#) are buildings that are based on one or more connected lines. These lines decide the general character of the building, while a set of properties (e.g. width, number of stories, etc.) decides how the exact geometry is produced from the lines.

### Instructions:

- Click on **Line edited buildings (1)** and create your first building
  - Click once to start your building, and click again to finish it
  - Notice that your **Area metrics (2)** are automatically updated
- Make another building by repeating the process, but this time using the shortcut “L” on your keyboard to activate the tool.
  - Connect the two buildings by finishing or starting your building on one of the blue nodes of the other building.
- Edit your buildings by clicking on the building once, and then dragging or clicking on one of the nodes that appear.
- You can move the whole building fast by dragging the whole building
- Click on one part of the building and change the number of floors in the right panel.
  - You will see that there is a difference if you click on a specific section or if you click on the line (selecting all the sections that are connected).



## Exploring more possibilities for your site

**Explore** is a toolbox for generating and working with multiple proposals at once. It will let you [generate new proposals](#), [iterate on proposals you find interesting](#), and [improve the height distribution](#) of buildings to achieve various qualities. With wait times counted in seconds rather than minutes or hours when generating layouts as well as height distributions, Explore will allow you to discover and evaluate more options for your site than ever before!

A site study is done through three stages: Input, Results, and Details.

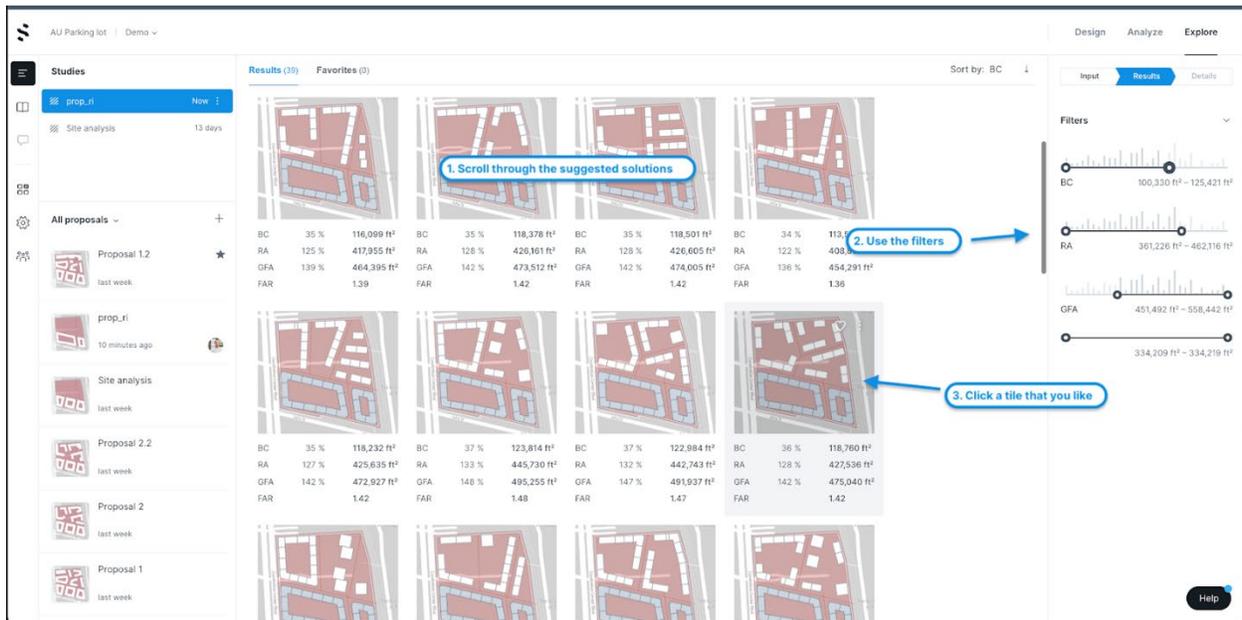
### Input

- Click on **Explore(1)**
- Change the type of study to a **Site study(2)**
  - Site study: Explore new buildings on your site
  - Height study: Explore alternatives to how heights/stories are distributed in your already existing proposal.
- **Select the areas (3)** on your site that you wish to exclude from generating new solutions on and click **Exclude (4)**.
- If you want to change the settings for the study, then **change the settings (5)**
- Click **Generate (6)**
- You can always go back to the Input settings and change them to run another study.



## Results

- You will be presented with a **tiled view(1)** of up to 100 solutions for your site. Each tile contains an image and high-level area statistics
- You can use **filters(2)** to limit the number of solutions
- **Click on a tile(3)** that you like to look at it in 3D and with some more details
- At this stage, we are only interested in finding a good starting point! We will edit the design further to make it fit our site and context.



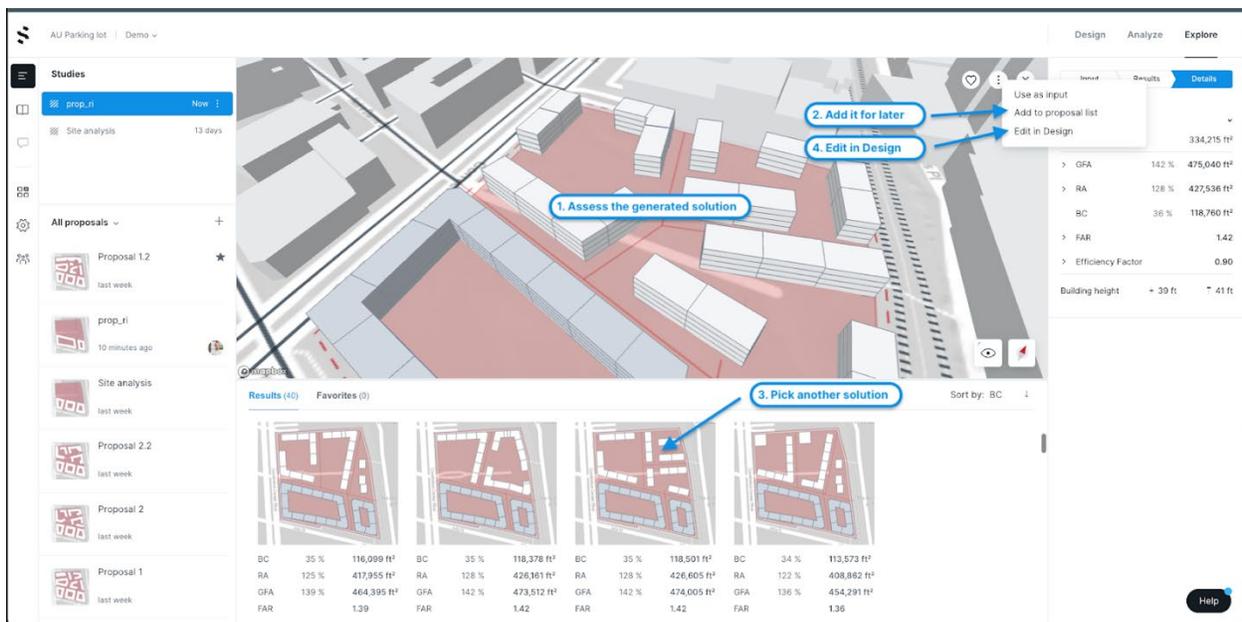
The screenshot displays the Autodesk CityEngine interface for a project named 'AU Parking lot'. The main area shows a grid of 16 suggested solutions, each represented by a small site plan image and a table of statistics. The statistics for each solution include BC (Building Coverage), RA (Roof Area), GFA (Gross Floor Area), and FAR (Floor Area Ratio).

Solution	BC	RA	GFA	FAR
1	35 %	116,099 ft <sup>2</sup>	125 %	417,855 ft <sup>2</sup>
2	35 %	118,378 ft <sup>2</sup>	128 %	426,161 ft <sup>2</sup>
3	35 %	118,501 ft <sup>2</sup>	128 %	426,605 ft <sup>2</sup>
4	34 %	113,408 ft <sup>2</sup>	122 %	408,850 ft <sup>2</sup>
5	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
6	139			1.38
7	35 %	116,099 ft <sup>2</sup>	139 %	464,395 ft <sup>2</sup>
8	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
9	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
10	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
11	139			1.38
12	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
13	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
14	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
15	139			1.38
16	35 %	116,099 ft <sup>2</sup>	139 %	464,395 ft <sup>2</sup>
17	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
18	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
19	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
20	139			1.38
21	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
22	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
23	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
24	139			1.38
25	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
26	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
27	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
28	139			1.38
29	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
30	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
31	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
32	139			1.38
33	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
34	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
35	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
36	139			1.38
37	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
38	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
39	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
40	139			1.38
41	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
42	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
43	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
44	139			1.38
45	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
46	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
47	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
48	139			1.38
49	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
50	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
51	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
52	139			1.38
53	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
54	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
55	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
56	139			1.38
57	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
58	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
59	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
60	139			1.38
61	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
62	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
63	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
64	139			1.38
65	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
66	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
67	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
68	139			1.38
69	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
70	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
71	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
72	139			1.38
73	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
74	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
75	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
76	139			1.38
77	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
78	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
79	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
80	139			1.38
81	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
82	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
83	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
84	139			1.38
85	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
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96	139			1.38
97	35 %	118,378 ft <sup>2</sup>	142 %	473,512 ft <sup>2</sup>
98	35 %	118,501 ft <sup>2</sup>	142 %	474,005 ft <sup>2</sup>
99	34 %	113,408 ft <sup>2</sup>	136 %	454,291 ft <sup>2</sup>
100	139			1.38

The interface also features a sidebar with 'Studies' and 'All proposals', a main results grid, and a 'Filters' panel on the right. The filters panel includes sliders for BC (Building Coverage), RA (Roof Area), and GFA (Gross Floor Area). The BC filter is set to 100,330 ft<sup>2</sup> - 125,421 ft<sup>2</sup>. The RA filter is set to 361,226 ft<sup>2</sup> - 462,116 ft<sup>2</sup>. The GFA filter is set to 451,492 ft<sup>2</sup> - 558,442 ft<sup>2</sup>. The FAR filter is set to 334,209 ft<sup>2</sup> - 334,219 ft<sup>2</sup>.

## Details

- **Look at the proposal(1)** in 3D to see if you think that the footprint can work for your site.
- If you like it, click on the three-dotted menu, and click **Add to proposal list (2)**
  - This will send that suggestion to the proposal list so that we can work on it later.
- Go ahead and **find another tile(3)** that you find interesting. Click on the three-dotted menu again, but this time, click on **Edit in Design(4)**
- This will take you straight to Design, where we can work more on the proposals that you have just added.



## Edit the buildings using the Rapid analyses

Spacemaker has built rapid analyses to aid you as a designer to make informed decisions as you are making your proposal. The real-time AI-powered prediction engines are trained on tens of thousands of simulations providing approximate results nearly instantly. These results are not exact but are close enough to offer valuable insights and support decisions while you design in the concept stage of your project. Detailed guides and short articles and how to use the different rapid analyses can be found [here](#).

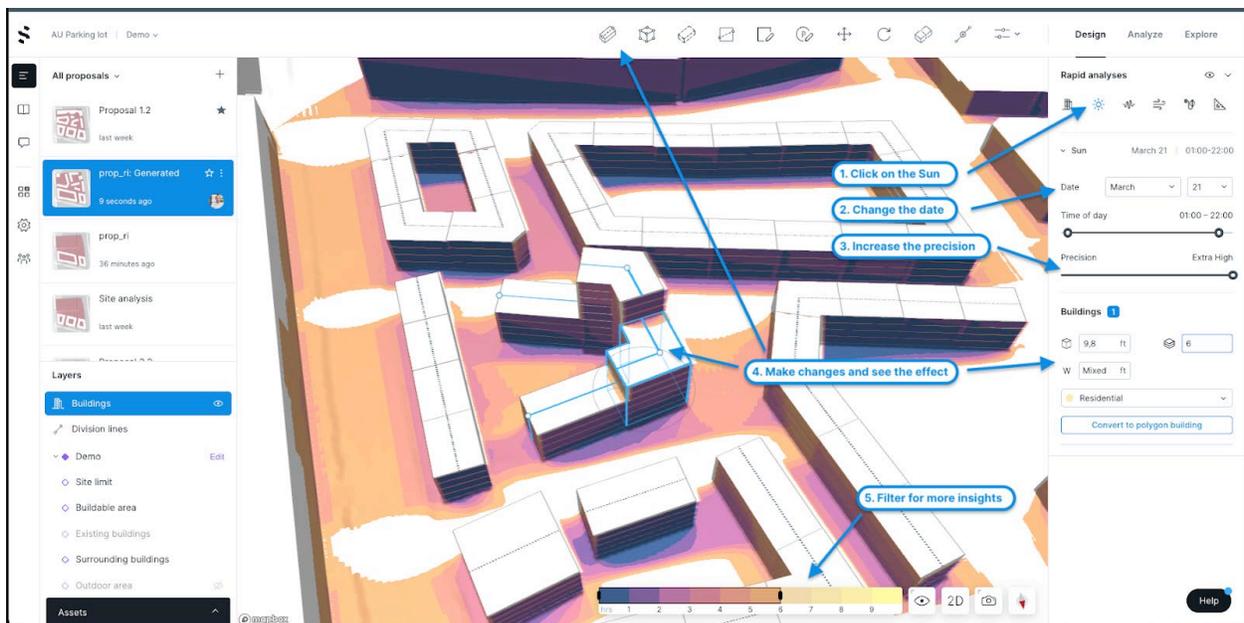
The buildings that you just created are **line edited buildings**. Which are also the same buildings that you just learned how to work with. Use the techniques of moving, changing heights, widths, and footprints, and see how the analysis results change instantly.

## Rapid analysis: SUN

The rapid sun analysis is made to help you make informed decisions based on how your volumes and buildings affect their surroundings. Try making changes to see if you can make better outdoor areas or ground floor apartment conditions. An in depth guide on how to use the rapid sun analysis can be found [here](#).

### Instructions

- Click on the **Rapid analyses for Sun (1)**
- Change the parameters
  - **Change the date(2)** to the sun equinox (21 March) to see how the site is performing on the “average day”.
  - I also suggest **increasing the precision(3)** to the maximum value.
- Edit, move, or connect your buildings to see the effect in real-time.
- Use the **scale bar(4)** to filter on target areas above or below a certain number of hours of sun.

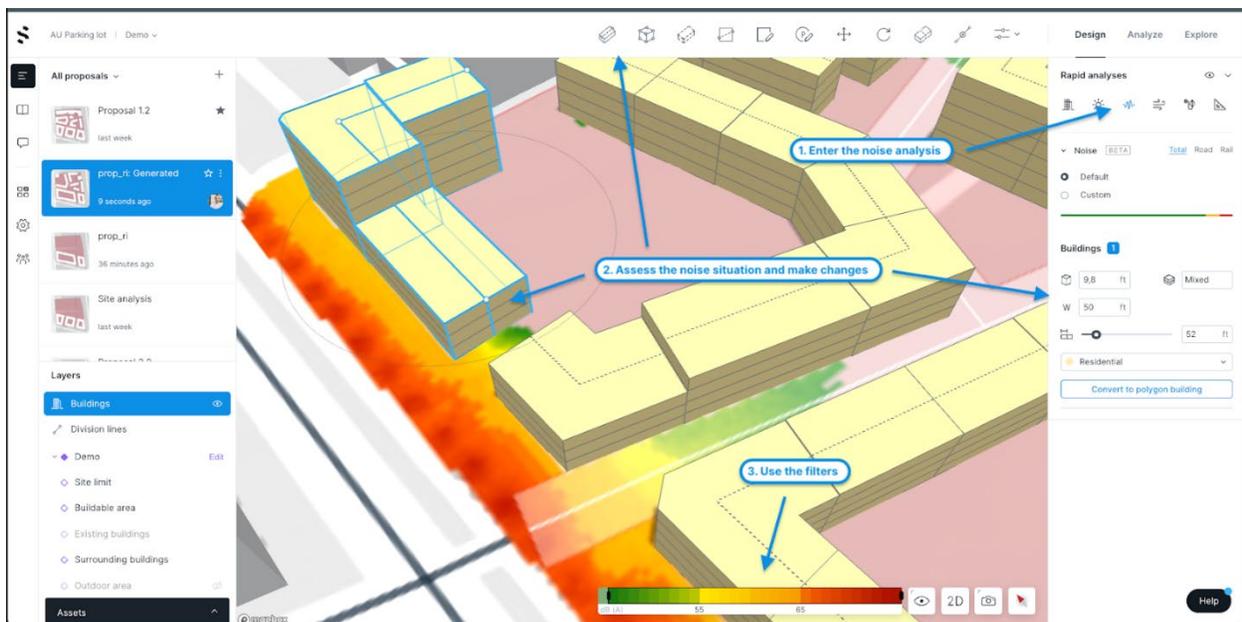


## Rapid analysis: NOISE

Think of the rapid noise analysis as an acoustician who has good intuition about how noise propagates and provides design advice quickly, and now you have it too. This analysis provides approximate noise level results nearly instantly. These results are not exact but are close enough to offer valuable insights and support decisions while you design and iterate on your proposal. A more detailed introduction to the tool can be found [here](#).

### Instructions

- Click on the **Rapid Noise Analysis(1)**
- Assess where you have challenging noise situations and **make adjustments(2)** to your proposals to try to decrease the amount of noise that enters your proposal. Are there any areas on your site that need a different approach?
- Use the **scale bar(3)** to filter on target areas above or below a certain amount of noise on your site.



## Rapid analysis: WIND

How many outdoor cafes have you eaten at where the napkins are flying, or when you turn a streetcorner and it blows like crazy! Well, part of the reason is because the designers did not have the time or tools to design around how the wind flow reacts to how the buildings are formed. In addition to be able to run a full computational fluid dynamics (CFD) analysis, we can now also offer you a rapid wind analysis. In other words, you now have the tools to design and iterate for the wind situation on your site! You can toggle between showing wind speed or comfort. Go to this [guide](#), if you would like to learn more about it.

Instructions:

- Click on the **Rapid Wind analysis (1)**
- Assess your proposal regarding your wind situations and **make adjustments(2)** to your proposals to try to decrease the amount of wind tunnels that is created by the placement of your buildings. Are there any areas on your site that need a tweak?
- Use the **scale bar(3)** to filter areas above or below a certain wind speeds.
- The default option is to run a **comfort analysis(4)**
  - The pedestrian comfort analysis combines the wind flow patterns with the probabilities defined in the wind rose to predict where there will be areas with uncomfortable wind speeds over time for a pedestrian. The Lawson LDDC scale then shows you what kind of activity would be fitting for any given point on your outdoor area.
- Try switching over to **Direction (5)** to test specific directions and wind speeds. Personally, I like to ramp up the wind speed, to design out issues on the windiest days.

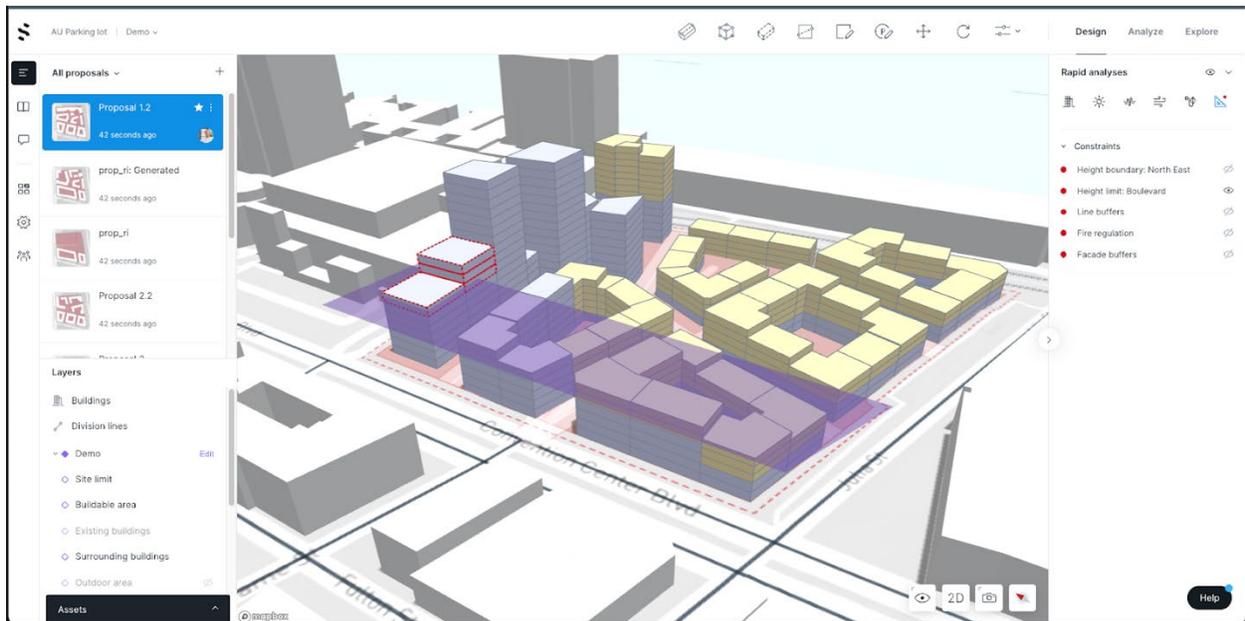


## Rapid analysis: OPERATIONAL ENERGY (BETA)

This analysis was not covered in the presentation, but it is very much well worth mentioning. Operational energy is the energy it takes to operate the building - lighting, heating, and cooling, powering appliances, etc. There are many factors that affect the operational energy usage of a building, some of which are determined in later design phases; think of insulation thickness, window shading, or HVAC efficiency. But critical choices like building form, the primary materials of the walls and roofs, and window-to-wall ratio are made early in the design process, often before energy experts are brought into the project. More about the analysis through this [guide](#).

## Rapid Analysis: CONSTRAINTS

We did not have time to cover this feature, but it will help you check your buildings for distances, heights, and constraints that you have for your site. To read more about how the feature works, and how you can apply it for your project, then check out this [guide](#). In the example below, we can see that there is a height limitation for parts of you site, and we can see which buildings that are breaching that requirement.



## Import

In addition to being able to create a proposal inside Spacemaker, it is also possible to import it from the software you are familiar with. This will be covered further in the “Migrate Revit proposals back to Spacemaker for updated analysis” - section.

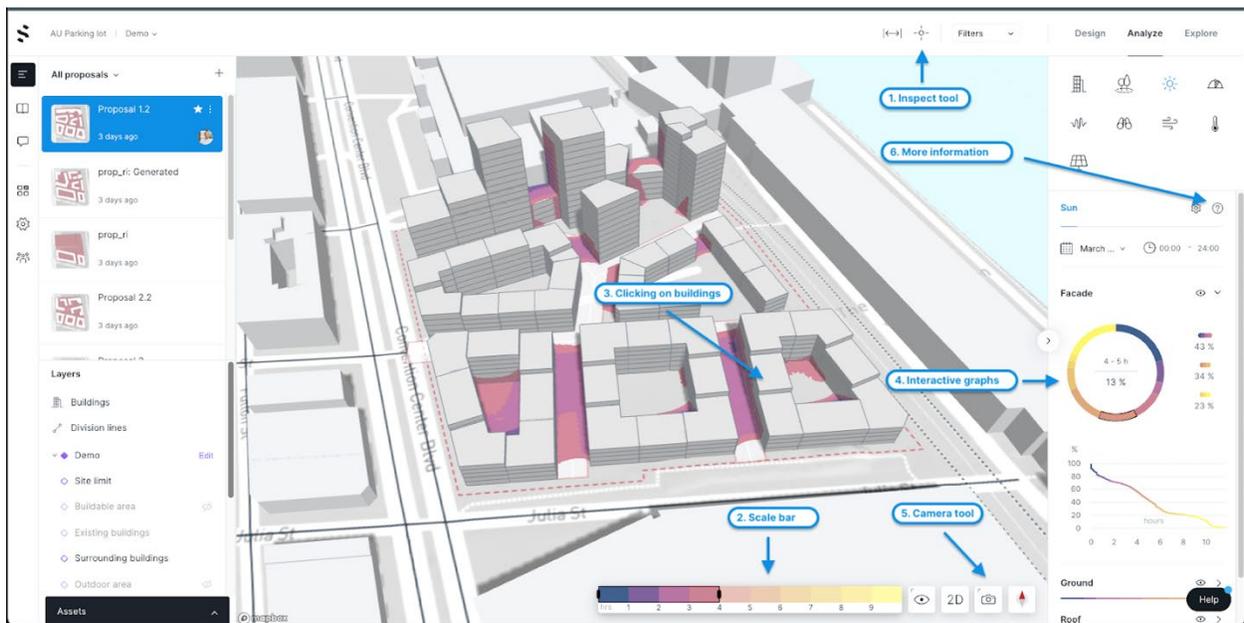
## Analyze

In Spacemaker's Analyze mode, you can view your proposals in 3D and run various analyses to assess risks and opportunities. You can select one of the analyses on the right side. The analysis plot in the main view and analytics on the right side will be updated depending on the selected analysis. A full overview over resources for all the analyses has been assembled conveniently at one place in our Help Center in a [section covering the Analyze tools](#).

In this mode it will not be possible to edit the design, but you will be able to inspect, filter and gain more insights for your proposal that you later can apply in Design or share with the rest of your team. As the Analyze mode is more looking than doing, I will introduce you to the tools needed and a general overview of each analysis, rather than giving you instructions for each.

### Basic tooling in Analyze

Each analysis has been tailored to try to give you the insight in the most intuitive way, which means that you have different visuals and representations for each but there are some tools that are universal and helpful to know about.



#### (1) INSPECT - tool ( i )

The inspect tool will help you inspect the values and conditions on your proposal for each given analysis. Simply click on the **Inspect tool** in the toolbar or use the shortcut “ i ” on your keyboard and click around on your proposal.

## (2) SCALE BAR - tool

You are already familiar with the filtering function at the bottom of the screen from the rapid analysis tools, and you will see it again here. This tool is useful to focus your analysis to get a better understanding of how your proposal is performing against specific criteria and identify any issues. Personally, I review the challenging areas and good areas separately as it offers more insight.

## (3) CLICKING ON BUILDINGS OR UNITS

Remember to click on the buildings! You can select volumes, a full block, or even single apartments in your design. As you will see, the stats in the right panel will update automatically. You will also see a plan view of the building with the qualities showing when you hover over each exterior facade.

## (4) INTERACTIVE GRAPHS IN THE RIGHT PANEL

It also works the other way around, so try to click or hover over your stats in the right panel and see how it affects the view of your model.

## (5) CAMERA - tool

The camera symbol at the bottom of the screen is used to save views and go back to them when you need to. This is often very handy to use for when you want to export different proposals with the same view for building your presentation. You can export the view in 4K with or without the stats associated with it.

## (6) FIND MORE INFORMATION ABOUT THE VIEWED ANALYSIS

Each analysis is different, and sometimes you would like to know more about the exact analysis that you are looking at so that you know you are understanding the results in the correct way. In the right panel for each analysis you can find a small “?”. When you hover over the icon it will show you contextual information about the analysis you are watching, and you can further click into helpful guides and articles. This is also the easiest way to access the documentation of how the analysis is working.

## The Analyses

In Spacemaker's Analyze mode, you can view your proposals in 3D and run various analyses to assess risks and opportunities. You can select one of the analyses on the right side. The analysis plot in the main view and analytics on the right side will be updated depending on the selected analysis.

All the analyses available in Analyze can be found in the right panel. A full view of guides and documentation can be found in the Help Center under the [“Analyze mode: Assess opportunities and risks”](#)-section

### General instructions

- Click on the **symbol of the analysis(1)** you would like to understand more about

- Some of the analyses has several ways of assessing that criteria. You will find these as **tabs(2)**.
- Depending on the analysis you have picked, there might be some settings that you can interact with. In most cases it is regarding the date for the analysis. If you do not find the date from the drop down, then click on the “Manage dates” option inside the dropdown. That will take you to Project settings and the area where you can add more dates.
- Look at the analysis results. Both the statistics on in the right panel and on the proposal itself.
  - Note that the statistics in the right panel is broken down into sections for facade (default open), ground and surrounding buildings.
  - Some of the analyses the statistics are interactive. Try to hover or click on them to find out more about your proposal.
- Use the the **scale bar (3)** to filter the view of the analysis results
- Use the **Inspect tool (4)** to look at specific values around the proposal.

## BUILDINGS

[Guide](#) [Technical documentation](#)

Spacemaker calculates several important measurements that are imperative for your proposals.



**Area (Default):** You will be able to see important calculations such as your area metrics, facade area, site area, building heights and more. If you have applied several [functions](#) to your site, then the area metrics will also be broken down into these and calculates the areas based on the factors or way you have specified in the Project settings.

**Parking:** If you have drawn parking areas in Design, then the stats for those areas will show up under this tab. You can also set specific parking targets in Projects settings, which will then show the results under this tab.

## OUTDOOR

### [Guide / Technical documentation](#)

Outdoor space is important for recreation, play and activities for different age groups. High quality outdoor areas can often be a defining factor when developing a concept. The premises of the outdoor areas are set early in the development phase, as the size and the qualities on the outdoor areas are determined by the placements and heights of the buildings.



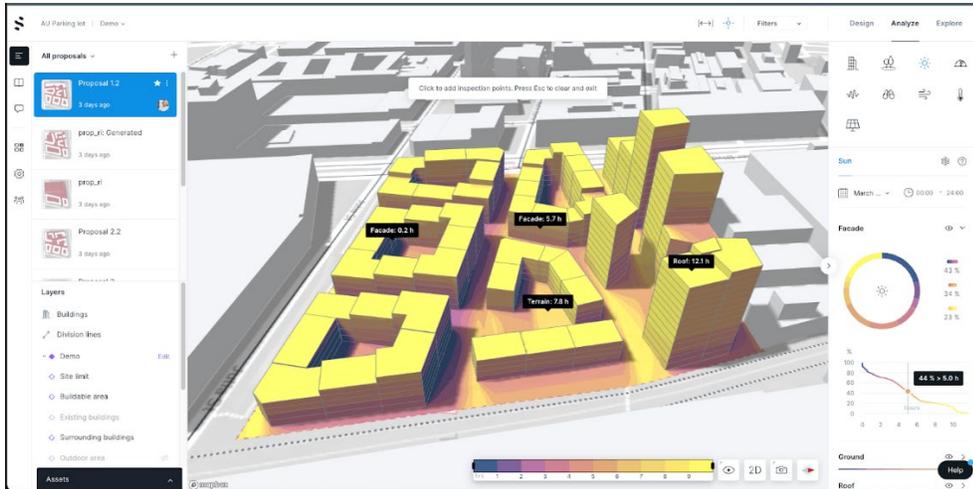
**Quality:** The outdoor area analysis calculates the amount of area that is left when you exclude non yellow or red noise levels and if the terrain is steeper than 1:3. Note that the default here is to only look at the ground. I would suggest editing this to “all” to see how the noise also has an impact on the roofs. Try to interact with the graphs to find more insights into how the shadows work and for how much of your site is sunlit at any given time of the day.

**Terrain:** The terrain steepness analysis addresses the terrain on your site through a steepness ratio. Terrain steepness can be part of project requirements, e.g. an outdoor area could be deemed inappropriate if the terrain is too steep. Furthermore, terrain steepness can show where it is costly to build. By having to move and level a significant amount of the terrain the projects costs increase.

## SUN

### [Guide](#) [Technical documentation](#)

The Spacemaker sun analysis measures the amount of time the ground and the face of the buildings, in the current proposal, receive sunlight at a given date. The amount of sun on your facade plays an important role of the quality of your proposal. E.g. in hotter climates it might be desirable to have less sun.



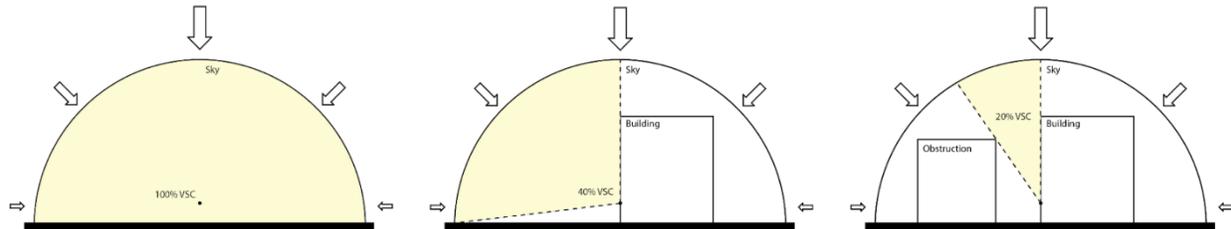
## DAYLIGHT

### [Guide](#) [Technical documentation](#)

We spend over 80% of our lives within buildings and numerous research studies have demonstrated that access to daylight has profound implications in terms of human health, happiness, and productivity. Using the Daylight analyses in Spacemaker you will get insight to indicate daylight performance in your buildings, highlighting facade areas with inappropriate levels of light to provide a high-quality living space.



**VSC - Vertical Sky Component:** The Vertical Sky Component analysis is a measure of how much light reaches the facades from the sky shown as a percentage score. For different points on the facade, the VSC score indicates how much light that would shine through a window placed at those points.



The results are divided into color bins indicating the daylight potential. The darkest areas mean that achieving reasonable daylight is often impossible and the lightest areas means that daylight conditions are usually satisfactory.

VSC default thresholds	Daylight conditions
$VSC \geq 27\%$	Conventional window design usually satisfactory
$15\% < VSC < 27\%$	Larger windows/changes in layout are usually needed
$5\% < VSC < 15\%$	Difficult to provide adequate daylight
$VSC < 5\%$	Achieving reasonable daylight is often impossible

**Obstruction angle:** is a geometric measure commonly used as a rule-of-thumb to indicate daylight potential. It measures obstructions, as other buildings, or terrain, and calculates the obstruction angle: the angle the obstruction makes above the horizon seen from the facade. It is suggested that all facade areas with obstruction angle above 45 degrees, must be examined further to ensure adequate daylight.

## NOISE

[Guide](#)      [Technical documentation](#)

Noise analysis is a powerful tool for decision makers to address problems related to environmental noise. Living in areas with high noise levels is associated with significant adverse health effects. Using the Noise analysis you can find answers to questions such as how likely is it that people will feel annoyed by noise, or how likely is it that residents will be exposed to unhealthy noise levels. You can also obtain information that can guide you in whether your designs meet regulatory requirements for issues such as limited noise levels on outdoor areas.

The noise analysis is broken down into three subsections: **Total** (Default), **Road** and **Rail** that shows the effect that each category has on the proposal. You can click on each to see the specific effect that source has on the project.



## VIEW

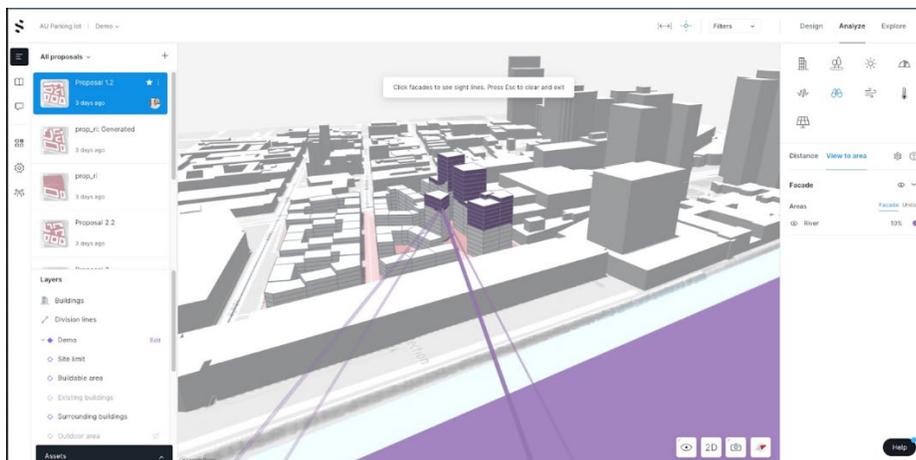
Guide ([Distance](#), [Area](#))      Technical documentation ([Distance](#), [Area](#))

Views from your apartment or the room you are in, either general or a specific view towards something, are highly sought qualities for any given apartment. Spacemaker calculates these views in two ways to give you the insights that you will need to make good decisions. Try using the Inspect tool (i) and click on the facade. It will show an illustration of how the analysis is working from that point.



**Distance:** The view distance analysis in Spacemaker measures the spaciousness around points on facades, giving an indication of how distant the view is. It measures how close you are to attaining 1000 meters (can be changed in settings) of view around each analyzed point.

**View to area:** The analysis shows how much of your facade that can see the area that you defined in “Layers > View area” and will color the facades for the areas that are able to see these areas. Note that each point is colored if it can see the area of interest, independent of the amount of area it can see. In other words, if it only can see a tiny part of the area, it will show as if it can see it.



## WIND

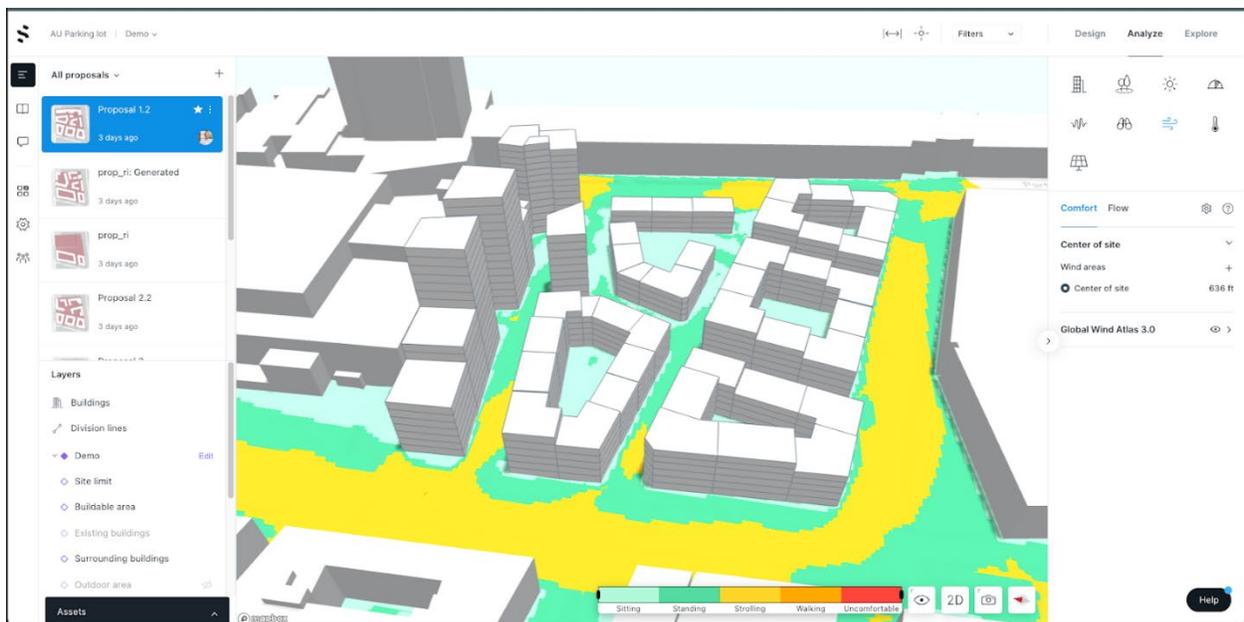
[Guide](#)      [Technical documentation](#)

The Spacemaker wind analysis is a powerful tool for early phase assessment of your site for various effects caused by wind. One unwanted side-effect is uncomfortable outdoor spaces due to high-wind areas, denoted as pedestrian comfort. Our wind analysis can be used to identify such problems and analyse the effect of design changes.

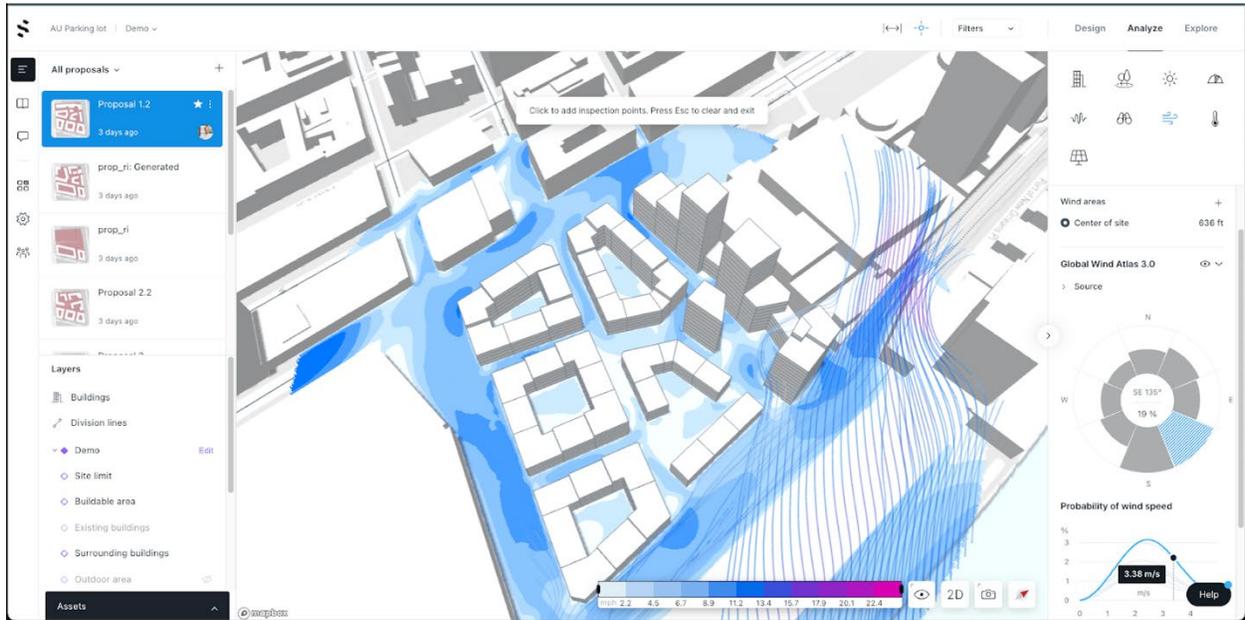
In warmer climates, ventilation through the site can help cool down the urban area at warmer days. With the Spacemaker wind analysis and an automatically provided wind rose local to your site, you can quickly investigate whether your design allows for airflow through your site.

// NOTE // This is the only analysis that you will need to manually trigger as the analysis is computationally heavy and takes a long time to compute. Also note that if you do any changes to the proposal in Design, you will have to run a new analysis.

**Comfort:** The pedestrian comfort analysis combines the wind flow patterns with the probabilities defined in the wind rose to predict where there will be areas with uncomfortable wind speeds over time. The output is showing areas of what kind of pedestrian activity would be comfortable at any given point.



**Direction:** The wind flow theme can give important clues to which direction that are causing pedestrian discomfort. Some locations on the site might be prone to wind from a specific direction, which is not always easy to interpret from the comfort analysis results alone.



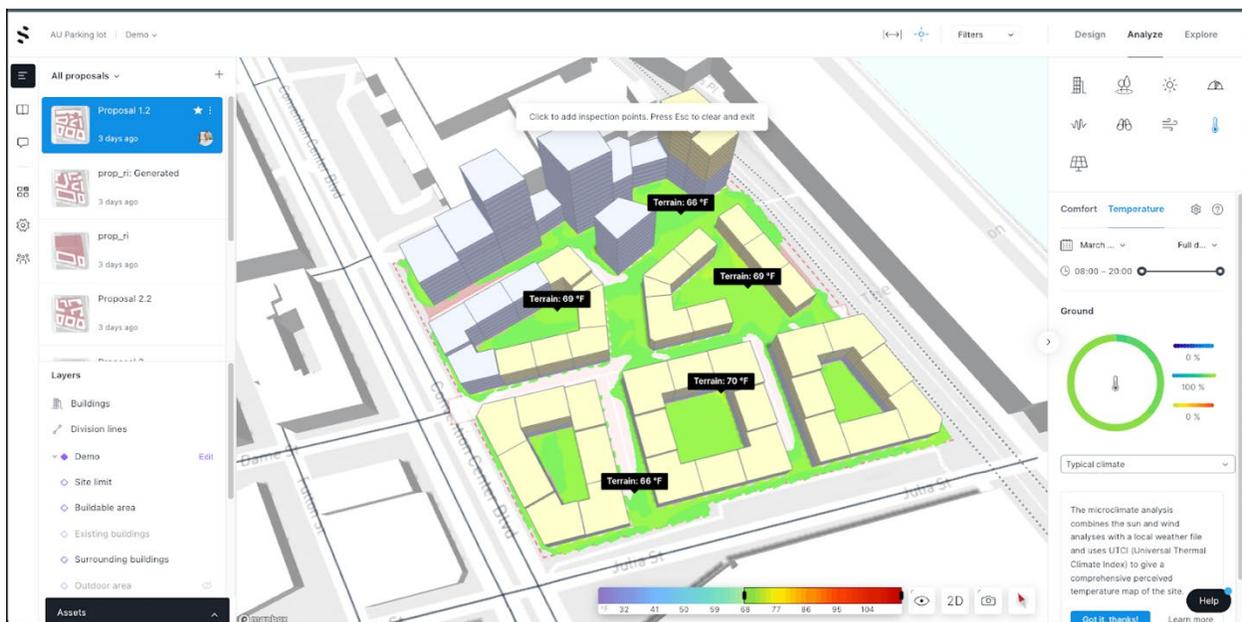
## MICROCLIMATE

### [Guide / Technical documentation](#)

The microclimate analysis combines the sun and wind analyses with a local weather file and uses UTCI (Universal Thermal Climate Index) to give a comprehensive perceived temperature map of the site, helping you understand how the local climate reacts to the shade and wind conditions your site plan creates.

**Comfort:** You'll be able to investigate the frequency of all perceived temperature results which is within the "comfortable range." As in the [London guidelines](#) for assessing comfort, the default comfortable range is 0 to 32 degrees Celsius. The comfortable temperature range can be adjusted in the analysis settings.

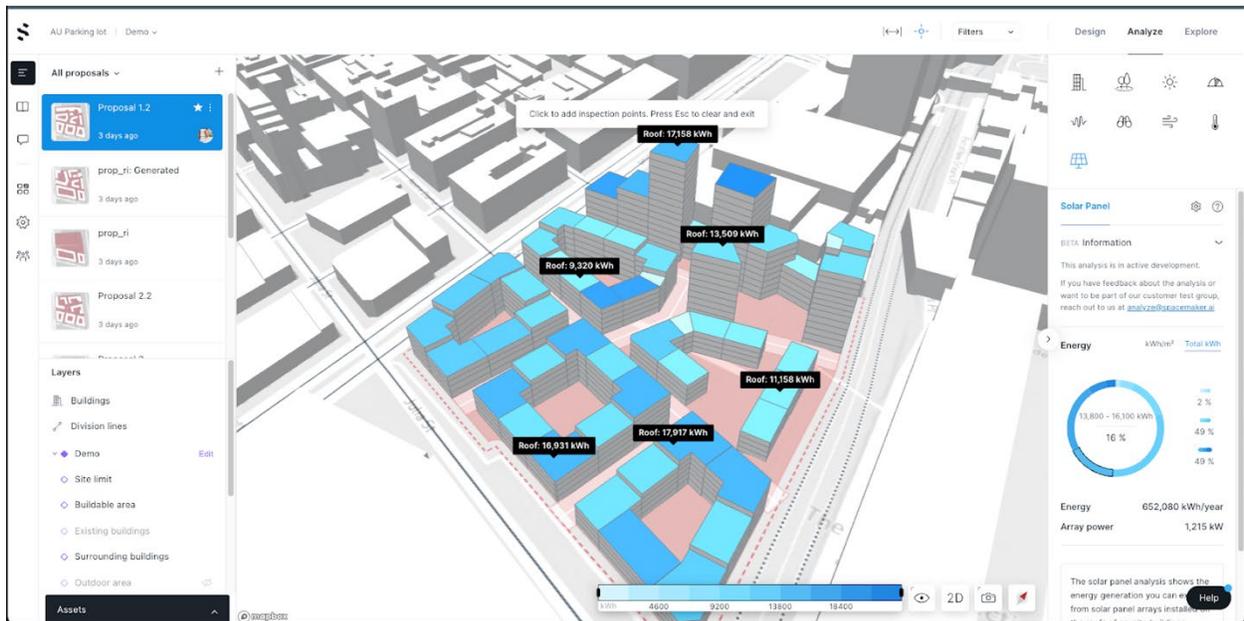
**Temperature:** This analysis outputs perceived temperature, similarly to when the weather forecast announces a temperature of 20 °C, which *feels* like 15 °C because of e.g. sun, wind, or humidity. You will be able to view the typical perceived temperature (50th percentile), the warmest (95th percentile), or the coldest (5th percentile) out of all the results we have calculated, on the date and for the time range you have selected.



## SOLAR PANEL (BETA)

### [Guide / Technical documentation](#)

The goal of the solar panel analysis is to assess the potential of a site for solar panel electricity generation, providing several outputs with just a few simple inputs. These inputs can be edited through the Project settings. A shortcut to get to the right area is to click on the mechanical wheel in the right panel. Our model takes the shading from existing, surrounding, and proposal buildings into account.



## Push Spacemaker proposals to Revit with the Revit add-in

When you have prepared your option studies in Spacemaker and analyzed them, you may want to bring one (or more) of those proposals into Revit for further editing. You will need to:

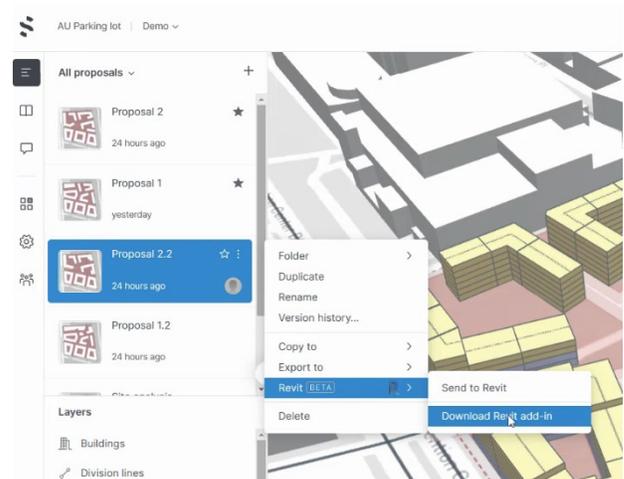
- Install the Spacemaker Add-in for Revit
- Export Proposal from Spacemaker
- Import Spacemaker Proposal into Revit
  - Import Proposals as Generic Models
    - Creating new massing in Revit
  - Import Proposals with Walls Floors Roofs

We describe these steps in more detail below.

### Install the Spacemaker Add-in for Revit

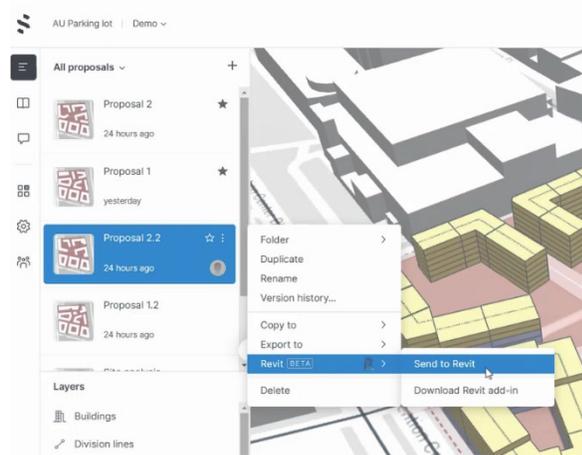
- The Spacemaker Add-in for Revit can be installed by selecting the three dots alongside any proposal, selecting **Revit** and **Download Revit Add-in**.
- This will download the installer. Double click the installer to install the Add-in.

Note: The Spacemaker Add-in works with Revit 2021 and above.



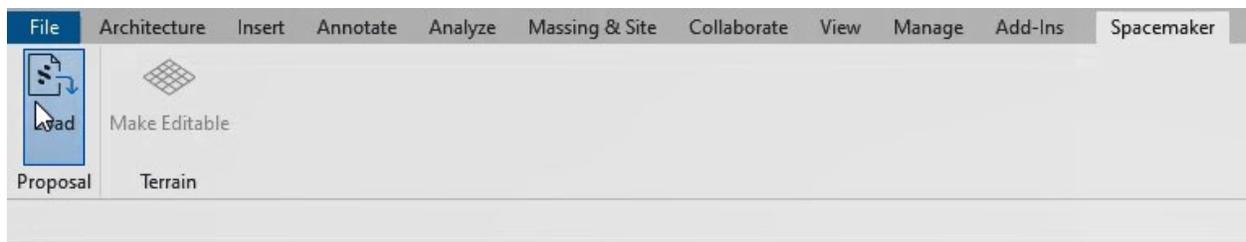
## Export Proposal from Spacemaker

When you have the Spacemaker Revit add-in installed (see instruction above) you export your proposal to Revit by selecting the three dots alongside the proposal you want to export, selecting **Revit** and **Send to Revit**.



## Import Spacemaker Proposal into Revit

- Follow the steps above to export your proposal from Spacemaker.
- Open a new Revit file and make sure you are logged in using your Autodesk Login – this is how your export is identified.
- Select the Spacemaker tab, which is available after installing the Spacemaker Add-in for Revit.
- Select **Load** to import your proposal



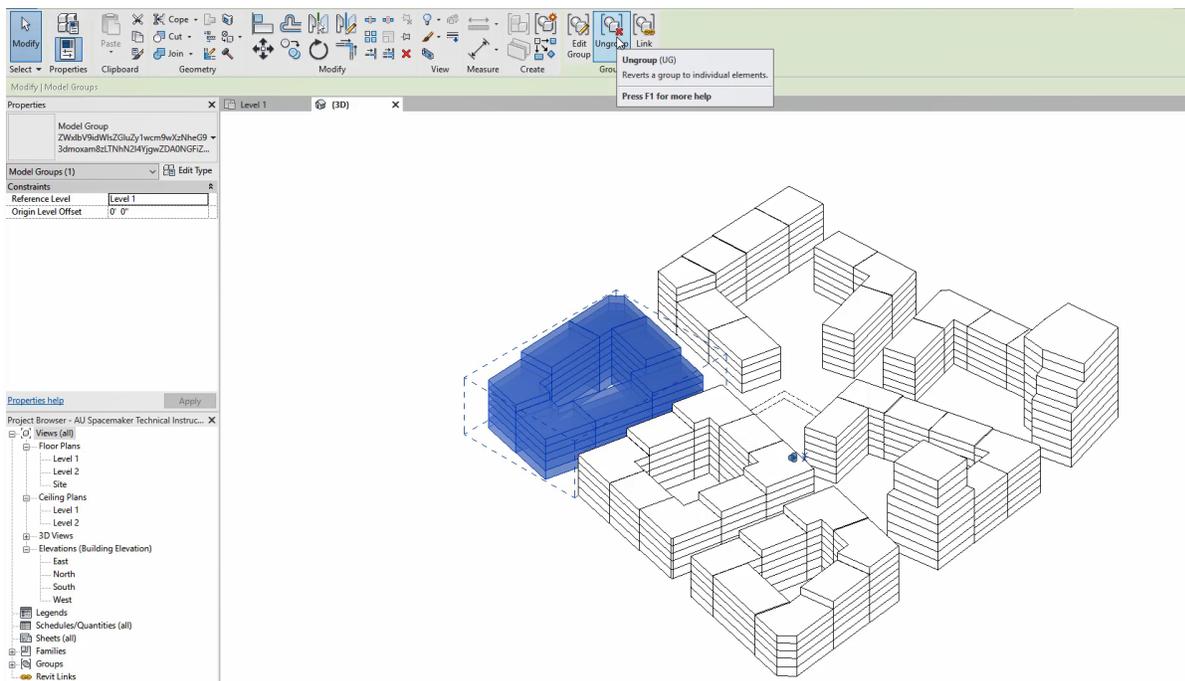
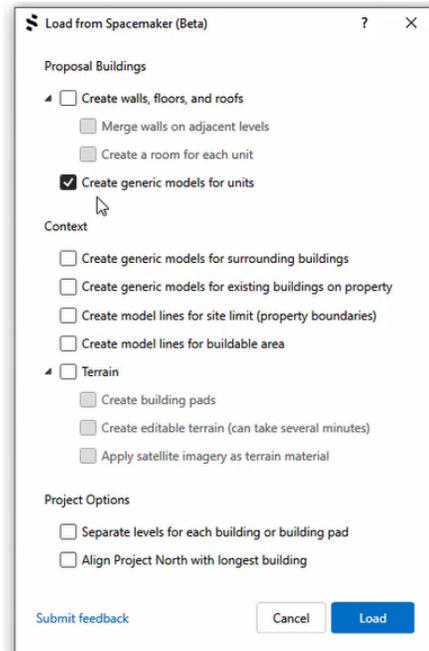
- You will see a menu where you can decide which elements you want to import including Proposal Buildings, Surrounding Buildings, Existing Buildings, Terrain, Site Limits, Building Limits.
- You can import your Proposal Buildings using **Create Walls, Floors, Roofs**, or **Create Generic Models for Units** we will explore when and why you would choose both these options below.

## Import Proposals as Generic Models

In the early stages of a project, you may want to import the Spacemaker massing to Revit as Generic models and adapt your proposals there.

Once you have imported your proposals can move the units using the standard Revit tools. Note the Spacemaker massing will be imported as Generic Models. Each building contains a series of grouped masses.

We recommend ungrouping the relevant building(s) before your start editing the proposal in Revit. The individual Generic Models cannot be edited but they can be deleted or moved. You can draw new Generic Models or Masses to import into Spacemaker (we have included instructions for how to Create new massing in Revit below).



## Creating new massing in Revit

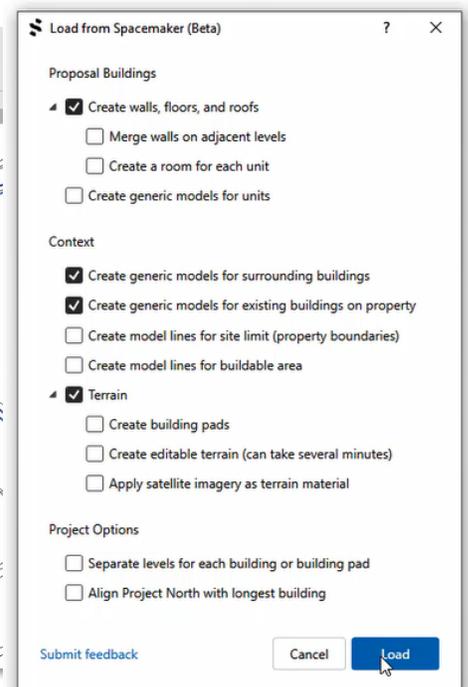
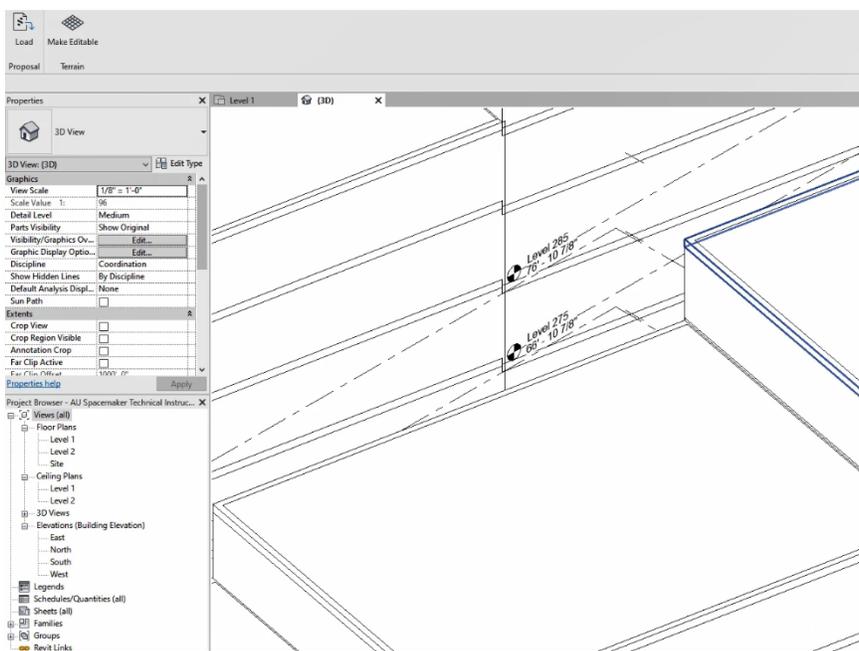
Having imported your Spacemaker proposal into Revit as Generic Models, you may wish to draw additional massing to add to your proposals.

- In your active Revit file navigate to **Massing and site tools** and **In place mass**.
- Start by setting a workplane to make sure you are drawing your elements on the same level before you draw the footprint of the new volume.
- When you have drawn the desired footprint, select the new lines and hit create form.
- Extrude the massing until you get the desired height.
- Select **finish mass**.

## Import Proposals with Walls Floors Roofs

When you have settled on a preferred design option in Spacemaker you may want to push that proposal into Revit to work up a more detailed design, e.g. drawing up typical floor plans. This option allows you to import your Spacemaker proposal into Revit with Walls Floors and Roofs pre-populated, gridlines are also pre-populated. This can save a huge amount of time as you transition to more detailed design phases.

Note you can also import generic models for surrounding buildings and existing buildings, and you can also import the Spacemaker Terrain. You also have the option to create separate levels for each building and to align project north with the longest building. Whether you use these settings will depend on your specific project.



## Migrate Revit proposals back to Spacemaker for updated analysis

Having updated your massing in Revit you may want to export the revised proposal back to Spacemaker to rerun your analysis and compare it with the previous proposals

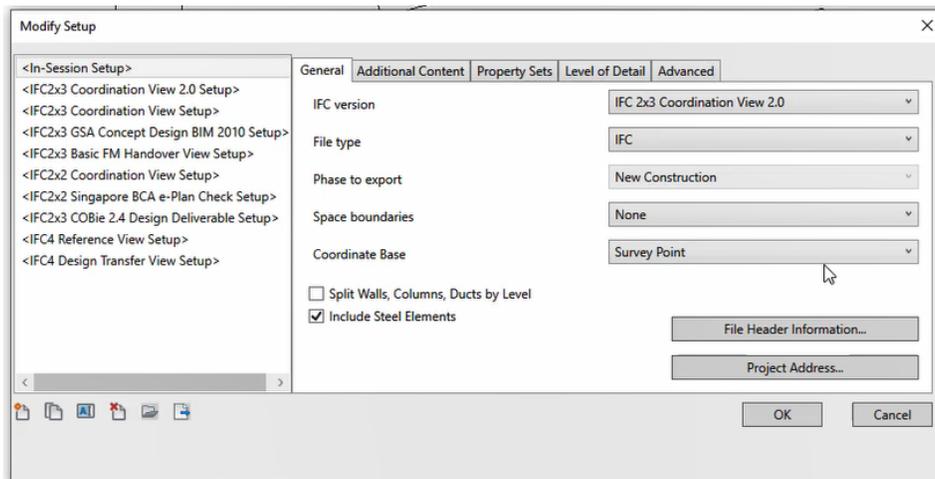
You will need to:

- Export Proposal from Revit
- Import Proposal into Spacemaker

We describe these steps in more detail below.

### Exporting Proposal from Revit

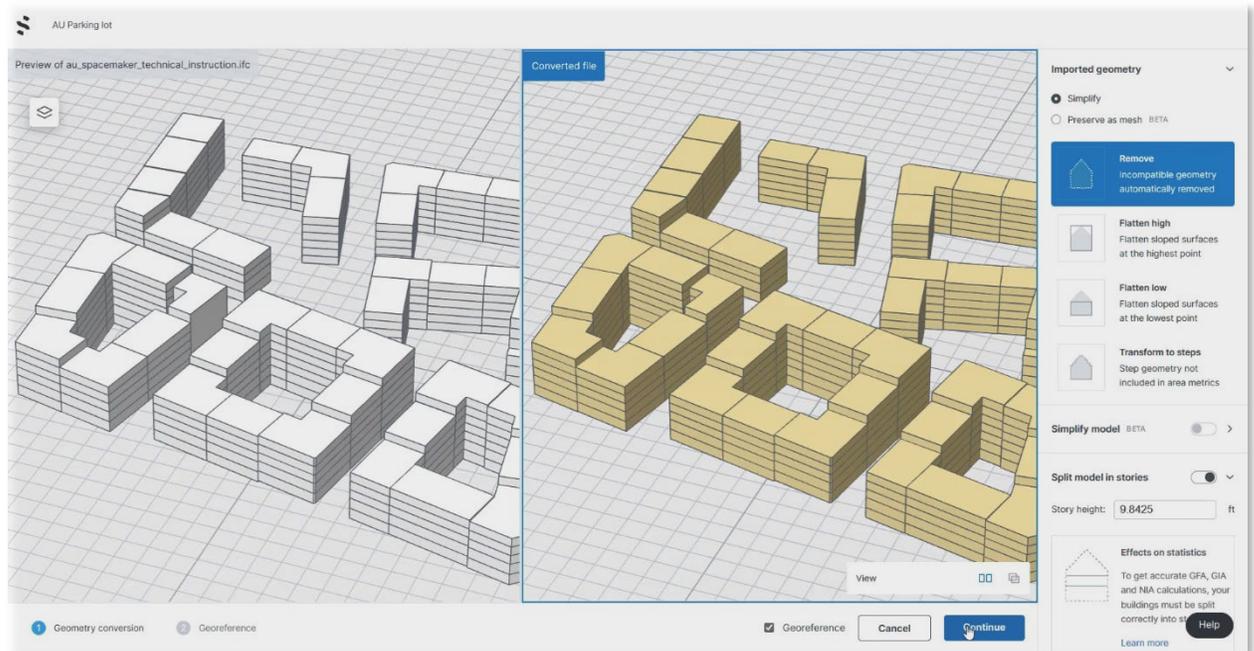
- In Revit, open a view where only the geometry you want to export is visible.
- From here go to **File** → **Export** → **IFC**
- Select **Modify Setup**:
  - In the *Additional Content* tab **Export only elements visible in view** should be toggled on
  - In the *Property Sets* tab **Export Revit property set** should be toggled on.
  - In the *General* tab specify Coordinate Base – we are using **Survey Point**.
  - Click **OK** to apply these settings.
- After changing the filename and the file location, click **Export**.



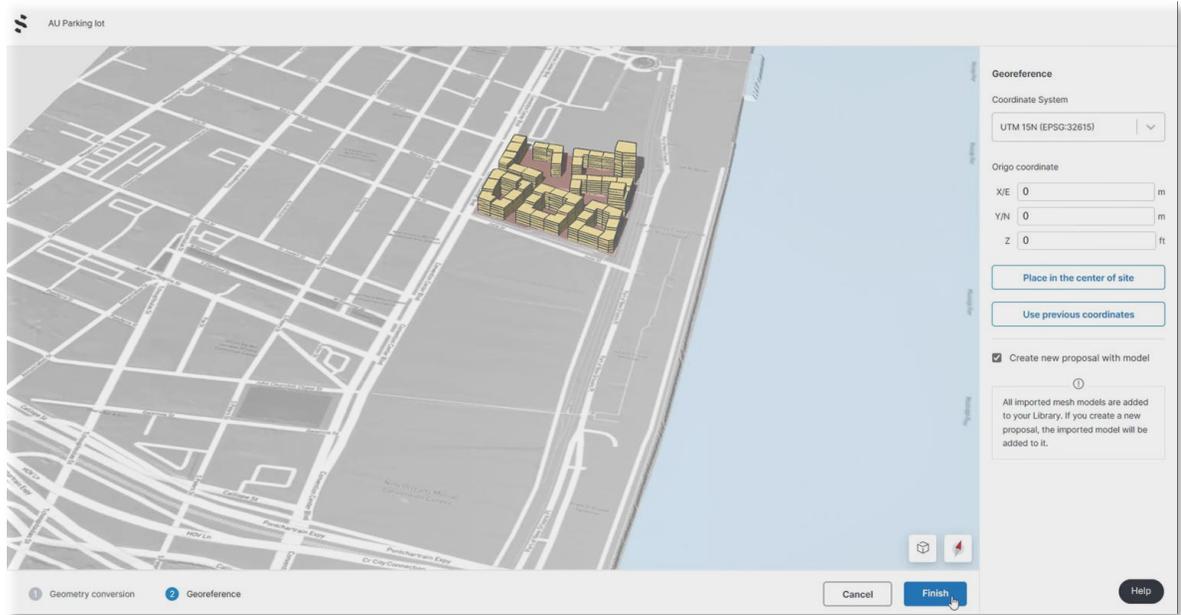
## Importing Proposal to Spacemaker

The import process is the same as importing any other 3D elements into Spacemaker:

- In Spacemaker select **Assets** in the bottom left corner of the screen, then hit **Import**
- Drag and drop or click to select the file you want to import.
- You will see a preview where you can validate the geometry shown and make sure everything is imported correctly.
- There are two import options:
  - **Preserve as mesh** this is best for more complicated models. The model will not be editable and only some of the Spacemaker analysis will be available.
  - **Simplify** this option will create an editable model and give you access to all the Spacemaker analysis tools. If you've model contains sloped rooves you can simplify them here. You can also split a model into stories here.



- Then you can **Georeference** the model, if you have used project origin as the coordinate base the coordinates will be 0, 0, 0.
- You can check the preview to ensure that the model is placed in the correct location before selecting **Finish**.



- Your imported proposal will be available for review and analysis alongside your other proposals. We recommend renaming the imported proposal to help identify it.

