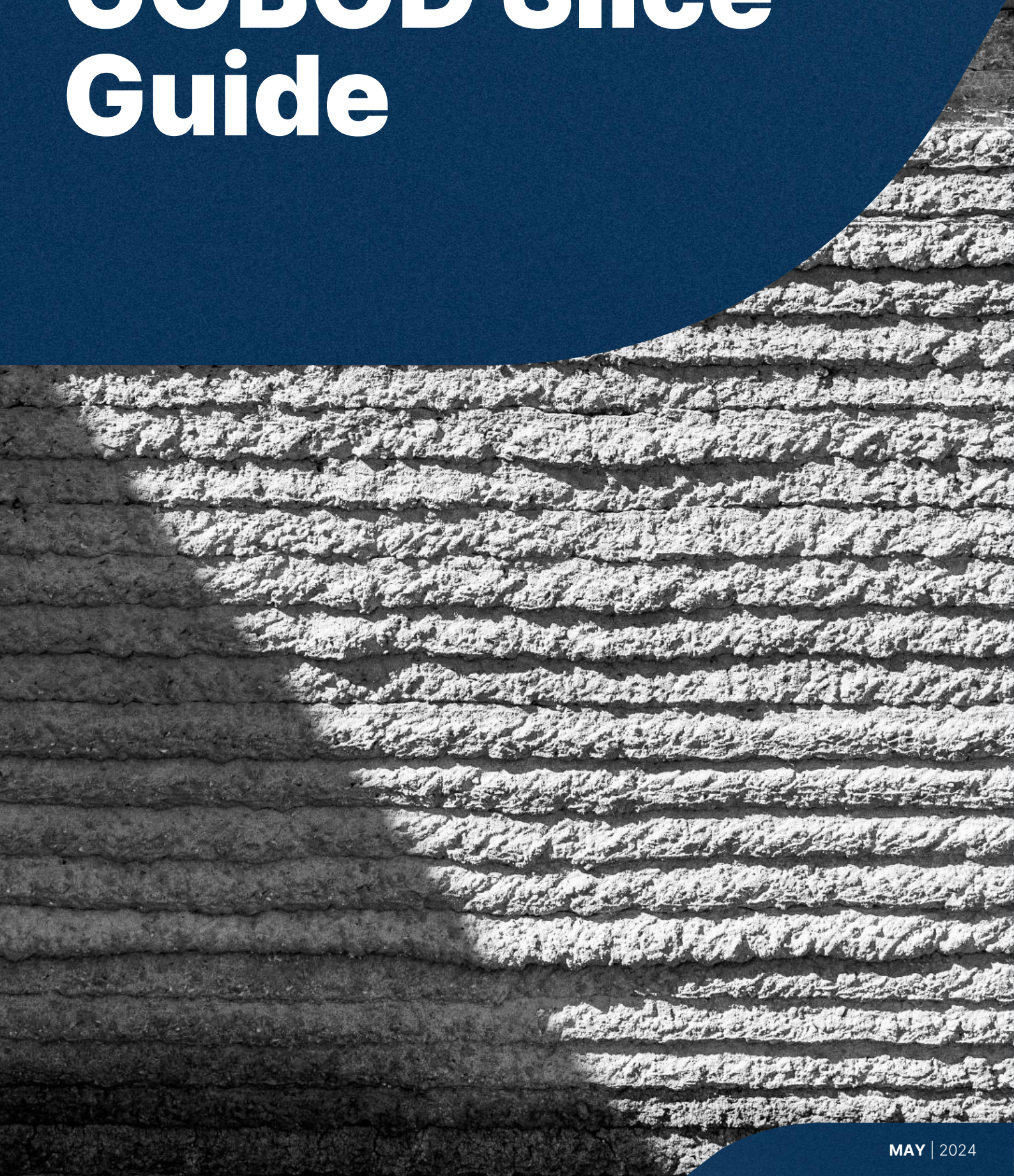


COBOD Slice version 2.7.2.

COBOD Slice Guide



Overview

This guide is a comprehensive resource for operators of the BOD2 and BOD3, focusing on the effective use of the COBOD Slice software. COBOD Slice, specifically designed for COBOD printers, is instrumental in preparing 3D models for printing. It facilitates the creation of G-code files, crucial for 3D printing processes, and their subsequent upload through the COBOD Web Control Interface.

The manual is divided into five key sections:

- ▶ **CAD-File Preparation:** Instructions on designing and exporting 3D models to make them print-ready.
- ▶ **User Interface Overview:** A walkthrough of the COBOD Slice user interface, focusing on its Settings and Viewport.
- ▶ **Feature Guide:** Examples illustrating the practical use of various COBOD Slice features to achieve specific printing objectives.
- ▶ **COBOD 3D Printing:** A Step-by-Step Checklist: An essential checklist detailing the key steps for a successful 3D printing experience.
- ▶ **Menus and Settings:** Concise descriptions of the various menus and settings in COBOD Slice, designed to help users navigate and customize the software effortlessly.

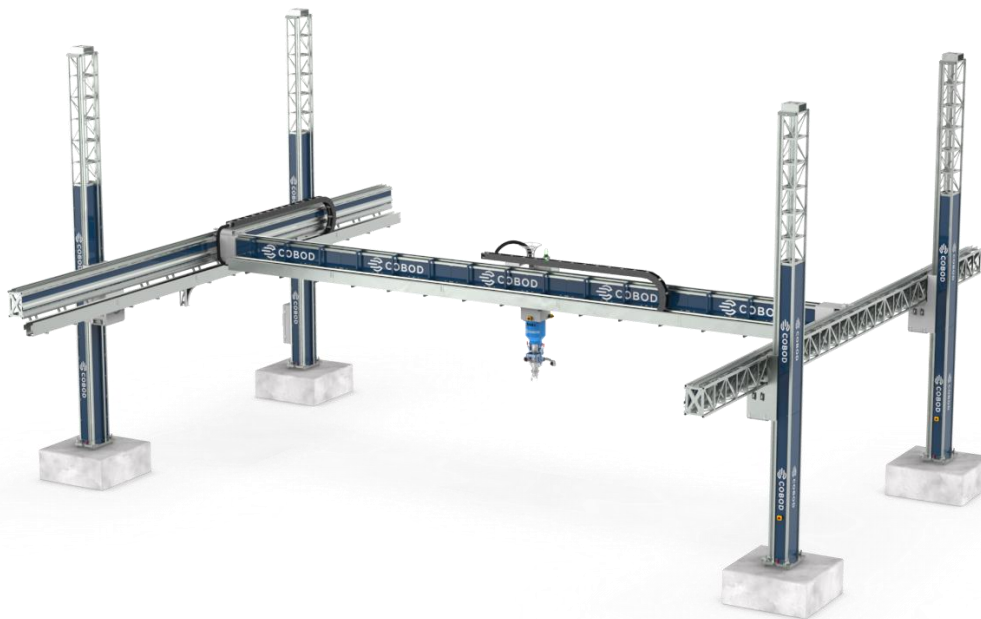


Figure 1: Illustration of the COBOD BOD2 3D printer.



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1. CAD-file Preparation

To ensure a CAD file is suitable for 3D printing, it's crucial to incorporate centerline surfaces into the architectural 3D model. Centerlines are pivotal for guiding COBOD Slice in accurately interpreting the model, especially in complex areas like corners and wall intersections. They allow for precise control over the printing path, mirroring the path that the center of the nozzle will take during printing. To prevent walls from being wider than intended, offset the centerlines into the wall by half the width of the nozzle, representing the nozzle's center.

Creating centerlines varies with the CAD software used. Typically, this involves a specific feature that offsets existing walls by an amount corresponding to the nozzle's width. Each wall may require multiple centerlines, as each represents a single layer in the 3D print. It's important to ensure these centerlines describe a surface, not a solid, for successful conversion into lines.

For more efficient slicing, simplify the model by merging adjacent surfaces that will be printed together. This simplification aids in object-based features of COBOD Slice, facilitating subsequent workflow steps.

Once the model is complete with centerlines, save it in a compatible file format, such as .STEP or .STP. Keep in mind that dimensions of the print cannot be altered in COBOD Slice. Therefore, precise measurements, like window dimensions, must be set in the CAD software beforehand. The model's placement within the CAD software is crucial for accurate slicing.

The model's orientation in the exported .STP file, especially in relation to the X and Y-planes, will be replicated in COBOD Slice. To ensure correct slicing, the model must be appropriately positioned in the CAD software. When setting the model's centerlines, which guide the nozzle path, avoid placing them directly on the X and Y axes' borders. Instead, position them at least half the nozzle width away from these axes. This ensures the print paths remain within the positive space of the CAD software.



2. User Interface

The COBOD Slice interface is organized into two primary sections: **Settings (1)** and **Viewport (2)**. These sections can be seen in the accompanying image.

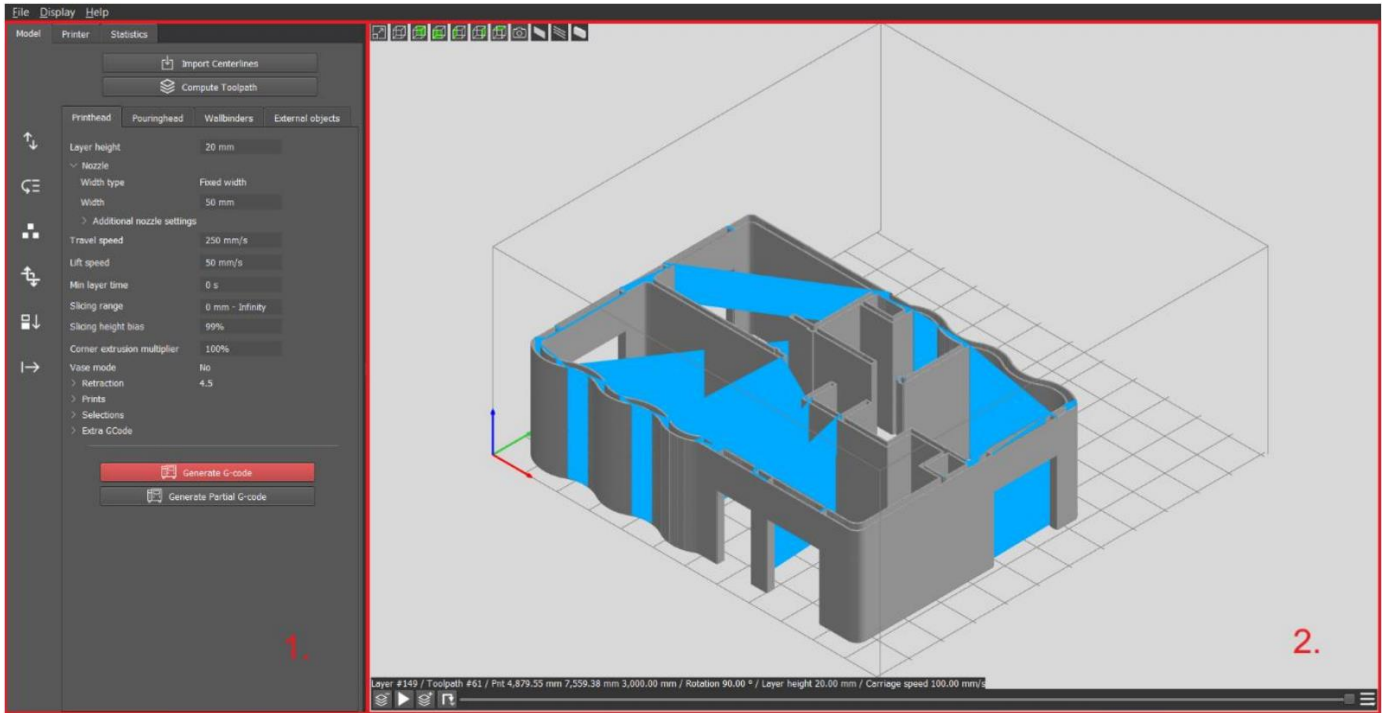


Figure 2: COBOD Slice interface.

2.1 Settings

The Settings section encompasses all the adjustable features and parameters necessary for generating G-code. Tailoring these settings allows users to meet specific requirements and preferences for their print project.

On the left side of the interface, you'll find a sidebar divided into three tabs: 'Model', 'Printer', and 'Statistics'. The 'Model' tab is your primary workspace, containing essential parameters for slicing the 3D model. The 'Printer' tab focuses on printer-specific settings like printer dimensions. The 'Statistics' tab provides insights into the computed toolpath. The 'Printer' tab automatically saves your settings, as these rarely need adjustments.

2.1.1 Model Tab

Key parameters in the 'Model' tab include 'Layer height', 'Nozzle' parameters, 'Print speed', and 'Toolpath Order/Orientation'. 'Layer height', located just below the 'Compute Toolpath' button, determines the individual printed layer's thickness and varies based on the material and nozzle used. Standard 'Layer height' typically ranges from 10 mm to 50 mm, with 20 mm being the default. For comprehensive details on other parameters, refer to the specific examples in the Feature Guide as well as the Menus and Settings section.

Nozzle Settings and Speed Adjustments

When configuring the 'Nozzle' settings in COBOD Slice, it's vital to match these settings with the physical characteristics of the nozzle being used. The two critical properties to specify are the 'Nozzle width' and 'Flap length'. 'Nozzle width' influences the extrusion amount, while the 'Flap length' ensures adequate nozzle lifting during travel.



Speed adjustments can also be made during printing through the COBOD Web Control Interface (CWI), but it's generally advisable to retain other parameters at their default settings.

The software allows individual setting of '*Print speed*', '*Travel speed*', and '*Lift speed*'. '*Print speed*' can be adjusted on a group basis, enabling different speeds for various sections. Additionally, the '*Minimum layer time*' is a crucial setting, dependent on the material's curing characteristics. This parameter automatically slows down the printhead if necessary to ensure sufficient curing time for each layer. However, be cautious with smaller objects, as this could affect print efficiency.

Speed Adjustments in COBOD Slice vs. COBOD Web Interface (CWI)

Speed can be tweaked during printing via the COBOD Web Interface (CWI), but it's important to note that this adjustment is scalar and impacts all base values uniformly. In contrast, COBOD Slice offers more nuanced control over Print, Travel, and Lift speeds. If the initial speed setting in the COBOD Slice is low, significant adjustments in the CWI could inadvertently increase the overall print speed.

Therefore, it's crucial to accurately set the parameters in COBOD Slice, keeping in mind the adjustment limitations within the CWI.

Optimizing Toolpath Orientation and Order

Modifying the toolpath orientations and orders can be highly beneficial for reducing print time. The '*Edit Toolpath Orientations*' and '*Edit Toolpath Order*' buttons in COBOD Slice allow for such adjustments. While the software optimizes the order to a certain extent, manual refinement often leads to further time savings.

Toolpath Orientation Consistency

The toolpath orientation is particularly important when using a single flap nozzle. Proper orientation ensures that the flap effectively smoothens the visible side of the walls. Moreover, it can slightly influence the length of the printed walls, as any residual material in the nozzle is deposited at the end of the toolpath.

To maintain consistent toolpath orientation, COBOD Slice allows users to color-code wall sides based on their position relative to the nozzle. When modifying the orientation of the desired objects using the '*Edit Toolpath Orientation*' button, enable coloring by navigating to the '*File*' menu and selecting '*Options*'. Here, under '*Toolpath Style*', choose '*Color sides*' to set your preferred colors for each side. This visual aid is invaluable for quickly identifying and correcting orientation inconsistencies.

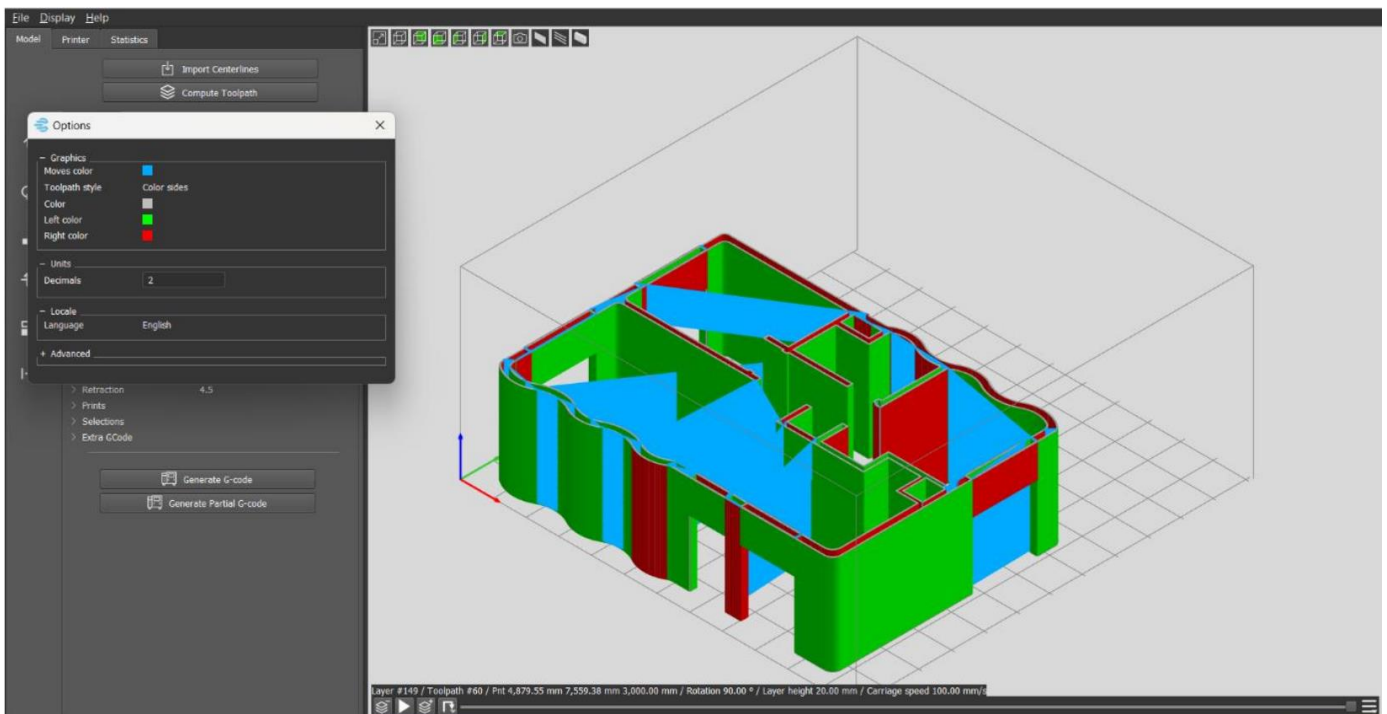


Figure 3: Toolpath Orientation



Starting Points on Toolpaths

Control over the start points of toolpaths on closed surfaces is also available. This determines the location of visible seams. By default, the toolpath starts nearest to the end of the previous path. To alter this, click on *'Edit start positions'*. This opens a menu where you can specify an XY point for each object. The toolpath will then start at the position closest to the specified point.

Compute Toolpath

After importing centerlines, compute the toolpath using the *'Compute Toolpath'* button. This process can vary in duration, depending on the model's complexity. The progress is displayed in the lower left corner of the interface. To prevent using an outdated toolpath after parameter adjustments, the *'Compute Toolpath'* button will flash red as a reminder to recompute.

G-code Generation and Upload

Once parameters are set and the toolpath computed, generate the G-code using the *'Generate G-code'* button. This file is then ready for upload to the printer so the print can begin (following a conducted and successful Start-up test). For continuing a print, the *'Generate Partial G-code'* button is useful. It creates G-code from the current simulation position, which can be adjusted as needed.

2.1.2 Printer Tab

The Printer tab displays the printer's size, influencing the 3D Viewport and allowing assessment of the printable area's suitability for the model. It also contains settings for toolpath segmentation, which, while generally best left at default, may require adjustments based on the printer's firmware version to prevent stuttering.

2.1.3 Statistics Tab

The Statistics tab offers valuable data on print length, speed, volume, and material throughput per layer. For a more realistic estimate, considering the printer's slowdown in corners, add approximately 30% more time, depending on the model's complexity. Also, anticipate a material waste of about 10% for cleaning and other processes, varying with print size.

2.2 Viewport

The Viewport in COBOD Slice is designed to display the model and its computed toolpath on a 1x1 meter grid. When a 3D model is imported, it appears within this grid, enabling users to check if it aligns with the expected coordinate system and whether it fits within the printable area for the chosen printer size.

2.2.1 Understanding the Coordinate System and Model Placement

In the Viewport, the coordinate system is depicted with three arrows at the origin: a red arrow for the x-direction, a green arrow for the y-direction, and a blue arrow for the z-direction. The grid, starting at the origin (0,0), extends to the maximum x- and y-coordinates that the printer can handle. For a model to be printable, it needs to be completely contained within this grid.

2.2.2 Simulating the Toolpath

Once the toolpath is computed, it is visualized in the Viewport where users can run a simulation. This simulation is controlled by a slider located at the bottom of the Viewport. Pressing the play button starts the simulation, depicting a red representation of the nozzle as it moves along the toolpath, simulating the wall printing process. The current layer, position, rotation, and speed of the simulated nozzle are displayed just above the slider, providing valuable information for debugging purposes.

Users can adjust the location of the simulation by dragging the slider or using the *'layer up'* and *'layer down'* buttons next to the *play* button. The *'Go to position'* button allows for setting the simulation at a position nearest to a specified point and the *'layer up/layer down'* buttons at a specific layer. In the menu located to the right side of the slider, the simulation



speed can be adjusted, with the *'home'* button resetting it to real-time speed. It's important to note that the simulation does not account for the automatic slowing down of the printer in corners.

Options to toggle the visibility of the nozzle status bar and to display the real rotation of the nozzle are also available. The accumulated rotation, which can become significant over the course of a print, is especially important to monitor for nozzles that cannot turn freely.

2.2.3 View Options in the Viewport

The printhead toolpath can be visualized as either lines or solids, and both visualizations can be toggled individually using the buttons in the top left corner of the Viewport. The model's visibility can be toggled in a similar manner. The *camera* button, also located in this area, allows users to switch between perspective and orthographic views. Other icons in the same area offer predefined views from different directions.



3. Feature Guide

3.1 Getting Started

To use COBOD Slice, start by importing a 3D model with integrated centerlines. This is done by clicking the *'Import Centerlines'* button and selecting the relevant file. Once the model is imported, adjust the necessary parameters and then use the *'Compute Toolpath'* button to calculate the printhead's path. This path is visualized in the Viewport, allowing for verification and ensuring the toolpath aligns with your requirements. After confirming the path, generate a G-code file by clicking the *'Generate G-code'* button, making the file ready for upload to the printer.

In the subsequent sections, we will demonstrate the use of specific COBOD Slice features.

3.2 Using Groups for Texturing Full Walls

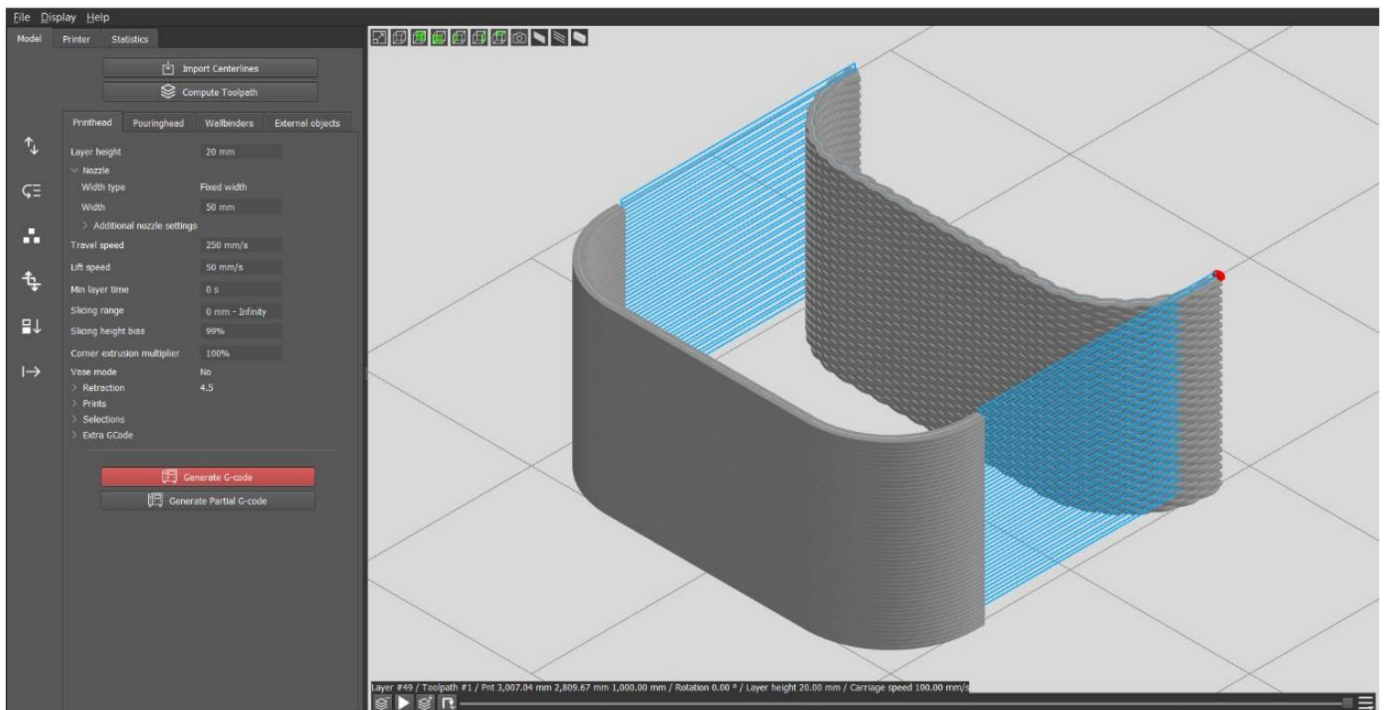


Figure 4: Example of design solution.

This example demonstrates how to divide a model into two groups and apply a texture to one of them. This technique can be similarly applied to add different effects to select walls. Begin by loading the provided STEP file from the directory. This file contains two similar objects, with the goal of adding a wavy texture to the object located furthest along the y-axis.

Firstly, separate the objects into two groups by clicking the *'Manage Groups'* button in the Model tab. Create a new group named *'Wavy'* by clicking *'Add group'* and then editing its name. Next, identify and drag the object furthest along the y-axis into the *'Wavy'* group. You can find the object by checking its number in the viewport, where the currently hovered object is highlighted. Assign a distinct color to each group for clear identification.

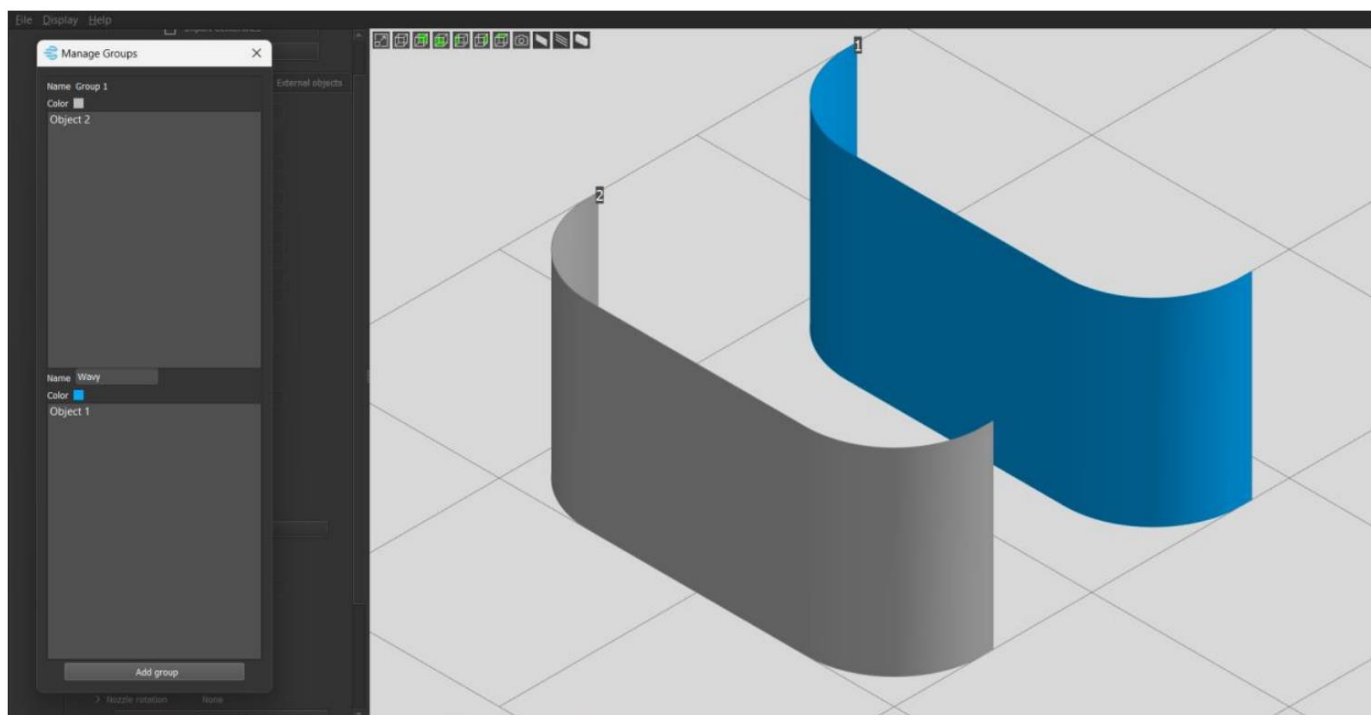


Figure 5: Division into two groups in COBOD Slice

Initially, only 'Group 1' is set to print. To print the second group, click 'Add Group' under the 'Prints' parameter group. Now, you can proceed to apply the texture.

Expand the 'Position offset' group and set the texture type to 'Image'. Upload the provided gradient texture, which represents a single wave pattern. To replicate this pattern, enable the repeat function and adjust the size: set the width to 100 mm and the height to 40 mm. The pattern works by interpreting the grayscale colors of the image, translating a range between white and black values into physical displacements. Here, set the white value to 8 mm, creating a movement range from 0 to 8 mm to the right, and leave the black values as default. Unless other adjustments are needed, like changing the nozzle width, retain the default print parameters. Remember to apply any parameter changes to both groups.

Upon computing the toolpath, the visualization should show the first wall being printed straight and the second with the intended wavy pattern.

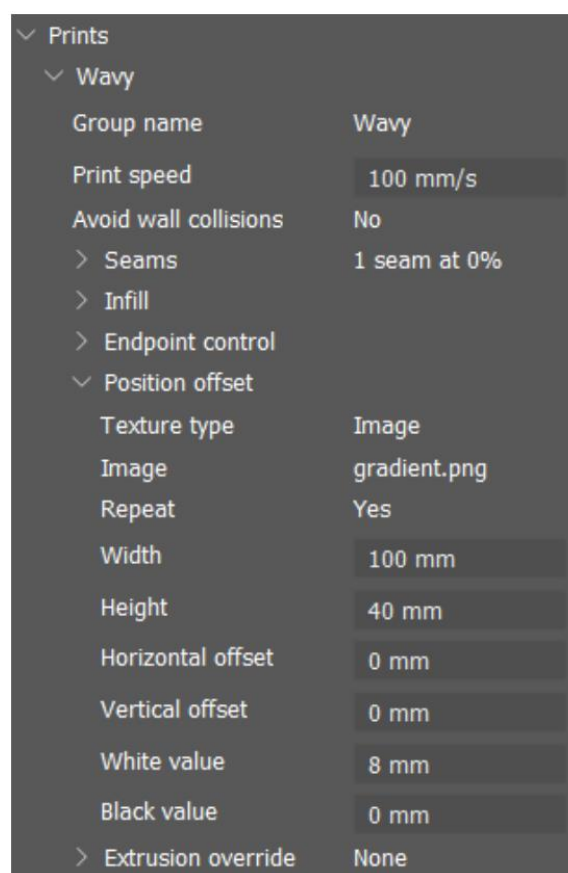


Figure 6: 'Prints' parameter group.

3.3 Optimizing Seam Placement in Closed Toolpaths

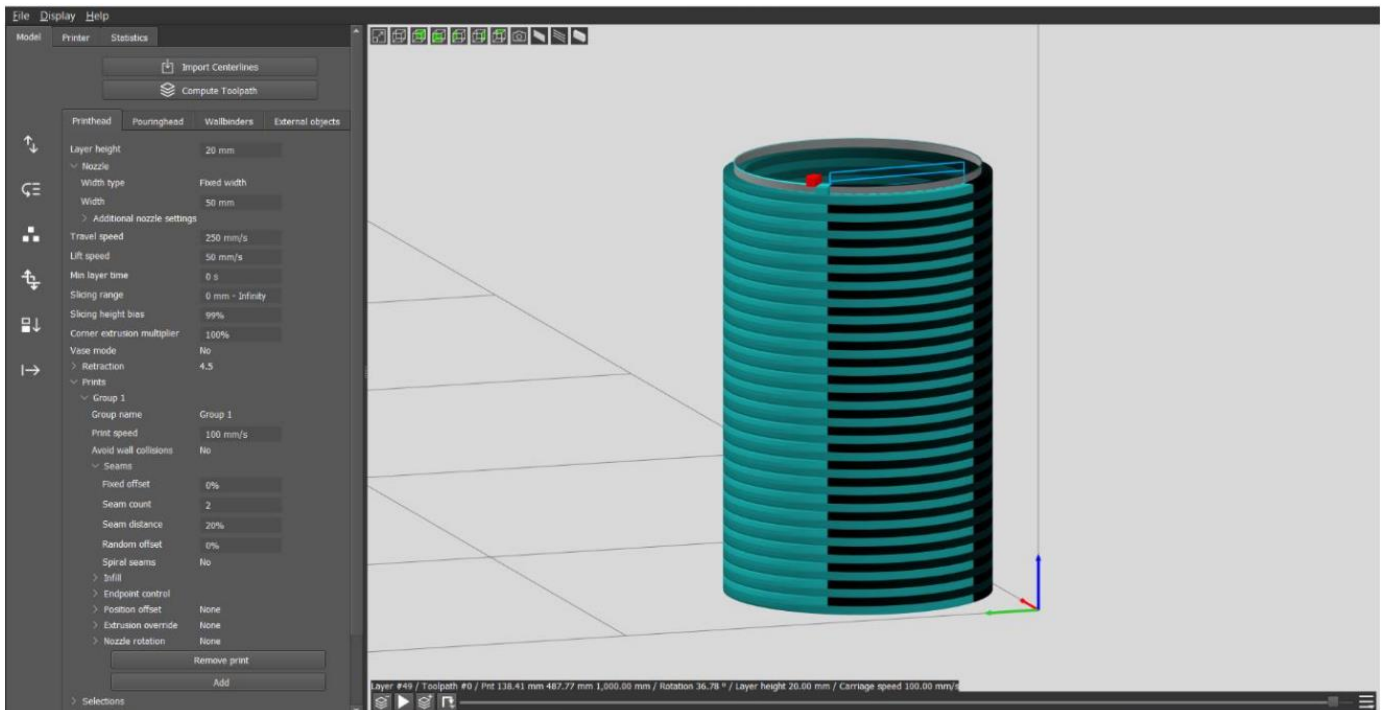


Figure 7: Example of seam placement.

This example illustrates the technique of optimizing seam placement in closed toolpaths to enhance the structural integrity and surface finish of 3D prints. When the starting points in consecutive layers align vertically, they can create a continuous seam, potentially weakening the print. This guide shows how to use two alternating seams to prevent the vertical alignment of starting points, thereby avoiding continuous seams.

Load the provided .STP model, which is a simple cylinder, to begin. In the 'Seams' group under the print group, set the 'Seam count' to 2 and adjust the 'Seam distance' to 20%. This distance, given as a percentage, ensures the seam remains straight on objects without a fixed diameter. Since this setting defines the spacing between each starting point, currently, it's not feasible to have multiple seams with varying distances between them.

After configuring these settings, press 'Compute Toolpath'. The toolpaths should now alternate starting points between two locations, spaced 20% of the layer length apart. To visualize this alternation, change the 'toolpath style' to 'Layer Gradient' in the options menu under the 'File' menu. This setting colors the toolpath to indicate the start and end of each layer, and the gradient can be customized for better visibility, particularly for larger models.

Be mindful that this method of seam placement may result in some layers starting on material that hasn't had sufficient time to cure. As an alternative consider checking the spiral seams checkbox which will instead create a single, spiraling seam.

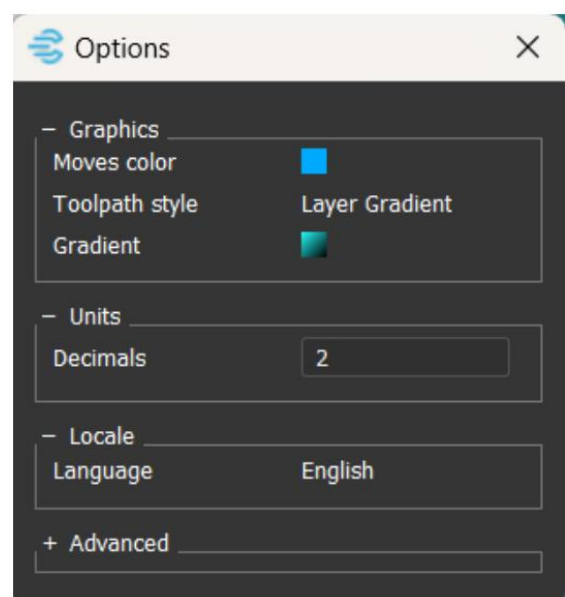


Figure 8: Options Tab



3.4 Using Groups to Add a Logo

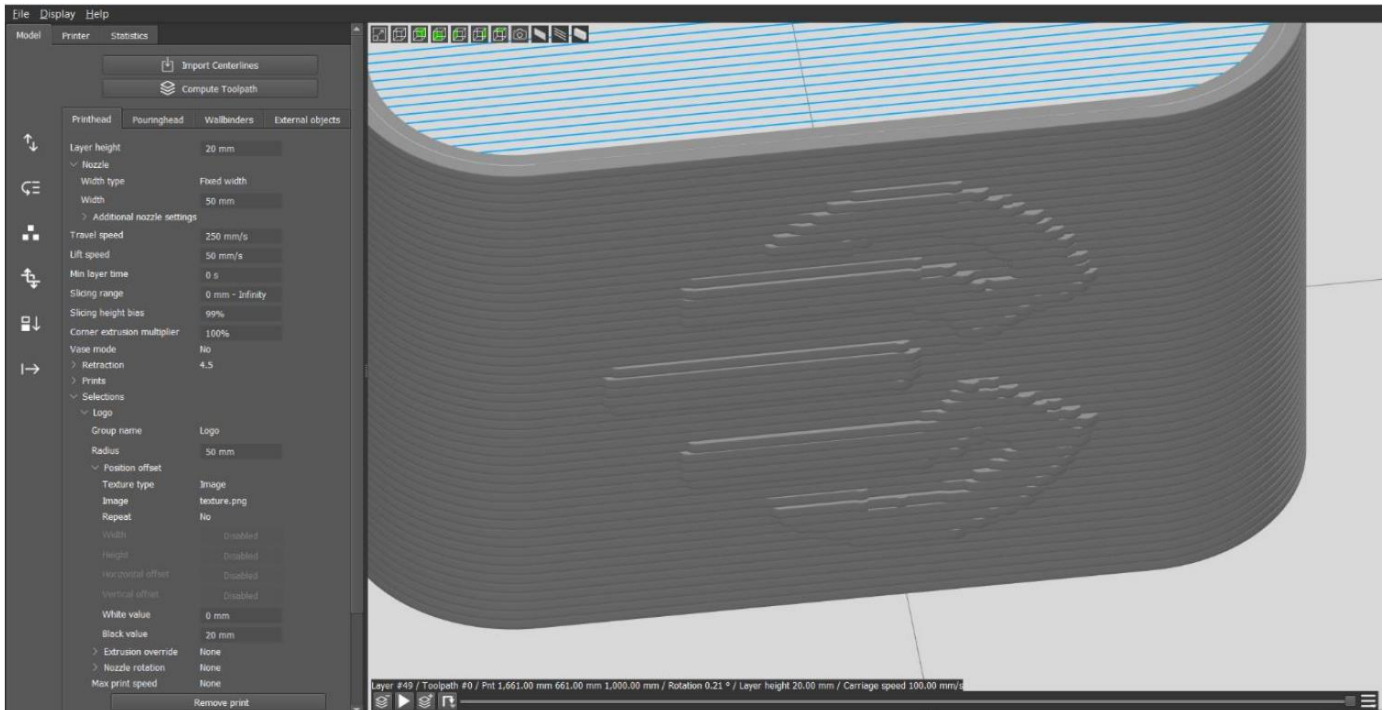


Figure 9: Example of adding texture.

This example demonstrates how to add a texture, such as a logo, to a specific section of a wall using COBOD Slice, without the need to segment the model of the printed wall.

Start by loading the supplied .step file, which contains two surfaces. The larger surface represents the main printing area, while the smaller surface is used to select a specific area for texturing. It's advisable to offset the selecting object slightly from the printed object. This precaution is taken because some CAD software might merge overlapping objects during export.

In COBOD Slice, group the objects to define their roles. Access the *'Manage Groups'* button in the *'Model'* tab, found in the left sidebar. Create a new group for the smaller, selecting objects. Hovering over the object in the render will highlight it, ensuring you select the correct one. However, if the view is obstructed, you may need to rotate the view. Name this group *'Logo'* and assign it a distinct color for easy identification. At this stage, if you compute the toolpath, only the larger object will be printed.

The next step is to designate the second group as a selector for a portion of the print. In the *'Model'* tab under *'Printhead' > 'Selections'*, press *'Add Group'*. Ensure this is under the *'Selections'* section, not *'Prints'*. By default, it will add *'Group 1'*, but change this to the *'Logo'* group. Now, the texture will select a part of the print but won't apply any effect yet.

To add the texture, unfold the *'Position offset'* menu under *'Selections' > 'Texture'* and set the texture type to *'Image'*. Choose an image file for the texture; an example is provided with the file. This image will be stretched across the selecting surface. The final step is to determine the wall offset based on the image's color, interpreted in grayscale. If the logo is colorful with a white background, adjust the black value, for example, to 20 mm, to achieve the desired texture effect. After recomputing the toolpath, the texture should be visible. To reverse the texture's orientation, use the *'Edit Selection Orientations'* button and select the texture that needs adjustment.

3.5 Marking External Objects

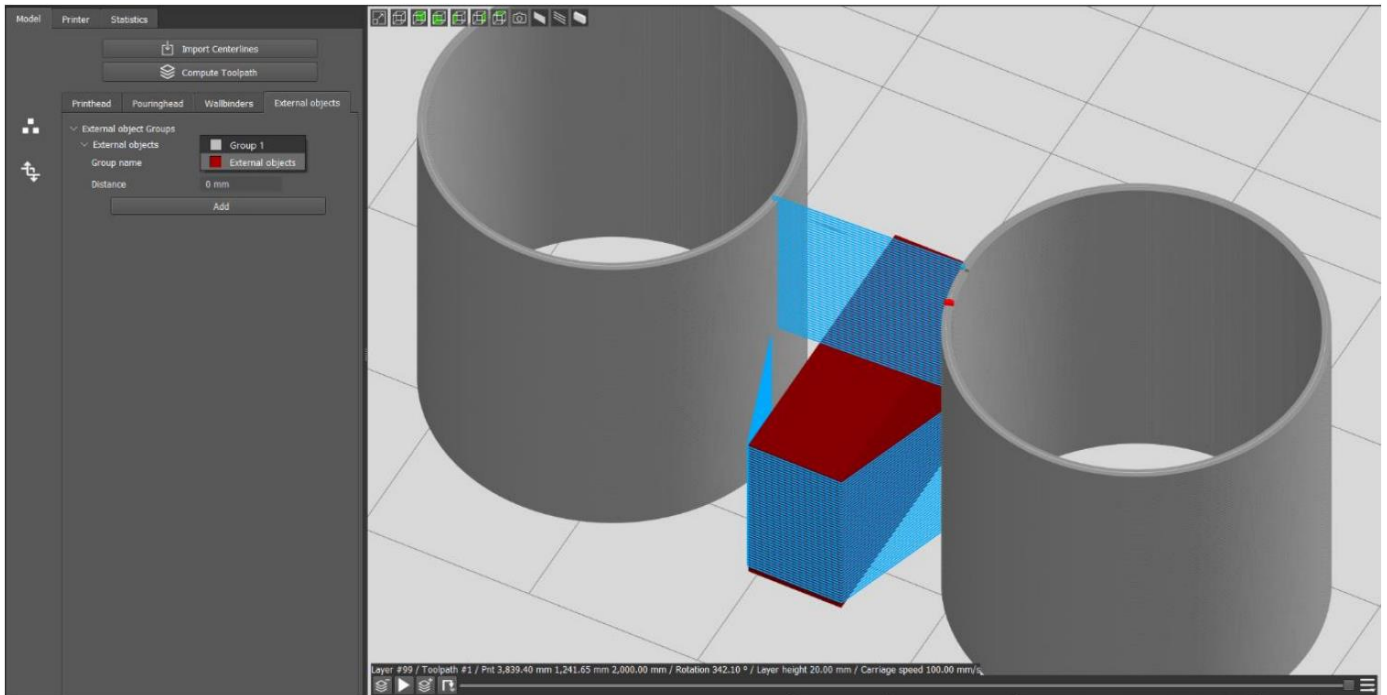


Figure 10: Example of marking external objects.

This example guides you through the process of marking external objects. This feature is essential to prevent the nozzle from colliding with objects, like rebar, protruding above the current layer height during printing. By marking these areas as external objects, the printer will automatically adjust its path, taking a detour to avoid any potential collisions.

Begin by importing the provided .STP model, which includes two walls and a solid object representing the external object. To categorize this solid object properly, use the *'Manage groups'* button. Create a new group and move the item representing the external object into this group. Name this group *'External objects'* and assign it a red color for easy identification. At this stage, after pressing *'Compute Toolpath'*, COBOD Slice will plan to print only the walls. However, you may notice that some travel paths come dangerously close to the external object.

To rectify this, navigate to the *'External objects'* tab within the *'Model'* tab. Here, click *'Add Group'* and select the *'External objects'* group you created. Once you recompute the toolpath with this setting, you will observe that the nozzle now alters its path, avoiding the marked external object.

If you find that the nozzle's path is still too close to the external object, you can increase the safety margin by adjusting the *'Distance'* field within the group. For instance, setting this distance to 50 mm will ensure the nozzle maintains a 50 mm gap from the external object.

3.6 Vertical printing with the Only print lines feature (Beta)

The *'Only Print Lines'* feature in COBOD Slice is developed for printing complex shapes like arches, where the printer head moves both horizontally and vertically. This feature stands out by focusing on printing just the lines of your design instead of entire surfaces. For utilizing this feature to its fullest potential, it's crucial that your CAD model distinctly highlights the lines you intend to print. The spacing of these lines should be planned to correspond with the intended layer thickness, ensuring precise and accurate print.

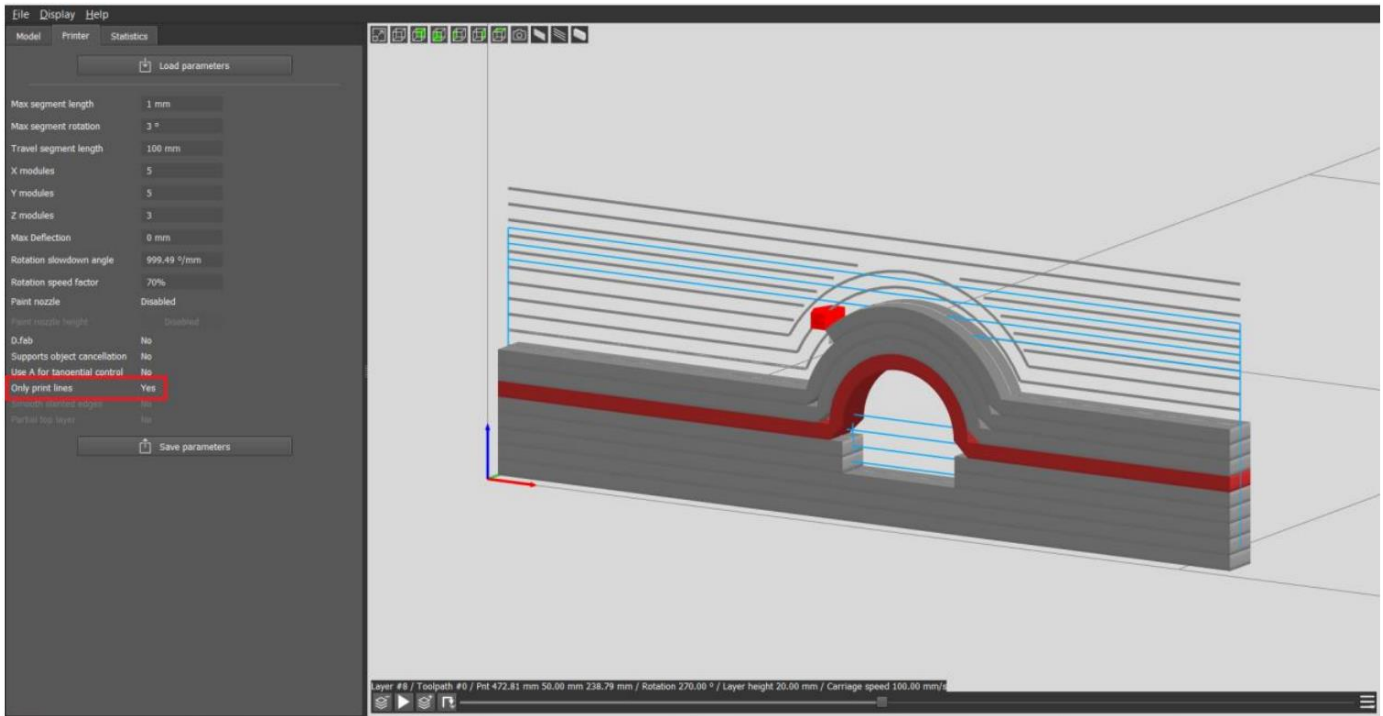


Figure 11: *'Only Print Lines' feature.*

To utilize the Only Print Lines feature, start by creating a CAD model that clearly emphasizes the lines, such as edges and wires, which you aim to print. The clarity and precision of these lines are vital for the success of the printing process. Once your model is ready, import it into COBOD Slice. The next important step is to set the *'Layer height'* in the *'Model'* tab. This thickness should match the spacing of the lines in your CAD model. Misalignment between these two can lead to printing inaccuracies. After setting the *'Layer height'*, check the *'Only Print Lines'* option in the *'Printer'* tab. Finalize the process by computing the toolpath and generating the G-Code.

When using the *'Only Print Lines'* feature, keep your CAD design as simple as possible. Overlapping lines or overly complex designs might confuse the toolpath generation process, leading to unsatisfactory printing results. It's essential that the specified *'Layer height'* matches the vertical spacing of your model's lines. If there's any uncertainty, it's advisable to double-check this in your CAD software. Additionally, before proceeding to generate the G-Code, preview the print path in COBOD Slice. Pay special attention to areas marked in red, as these indicate sections where the printer will be printing mid-air, a unique aspect of the *'Only Print Lines'* feature.

3.7 Compensating for Steel Truss Sag (Beta)

In large-scale 3D printing, one of the challenges encountered involves the bending of the extensive steel supports that uphold the printer. These supports, due to their length, are prone to sagging under the combined weight of the carriage and the structural weight of the truss itself. The sag correction feature in COBOD Slice is designed to counteract this deflection, ensuring that prints maintain consistent accuracy and uniformity.

The sag correction works by adjusting for the downward curve or sag that occurs as the carriage moves across the span of the trusses. The sag is most pronounced at the midpoint of the truss's span. To address this, the feature modifies the printing path, especially the height on the Z-axis, to compensate for the sag. By printing slightly higher in the middle, where the sag is greatest, the feature ensures the finished print is level.

Setting up the sag compensation in COBOD Slice involves a few key steps. First, you need to enter the number of '*X Modules*' of your printer. These modules refer to the segments along the printer's X-axis, and the correct count is essential to determine the scale of adjustment needed over the truss's length. The next critical step is to measure the '*Maximum Deflection*', the term used for the greatest expected sag at the center of the truss along the X-axis. This measurement can be obtained by positioning the printing carriage at the midpoint of the X-axis, measuring the vertical distance from the carriage to a fixed point on the ground, and then repeating the measurement with the carriage at one end of the X-axis. The maximum deflection is the difference between these two measurements.

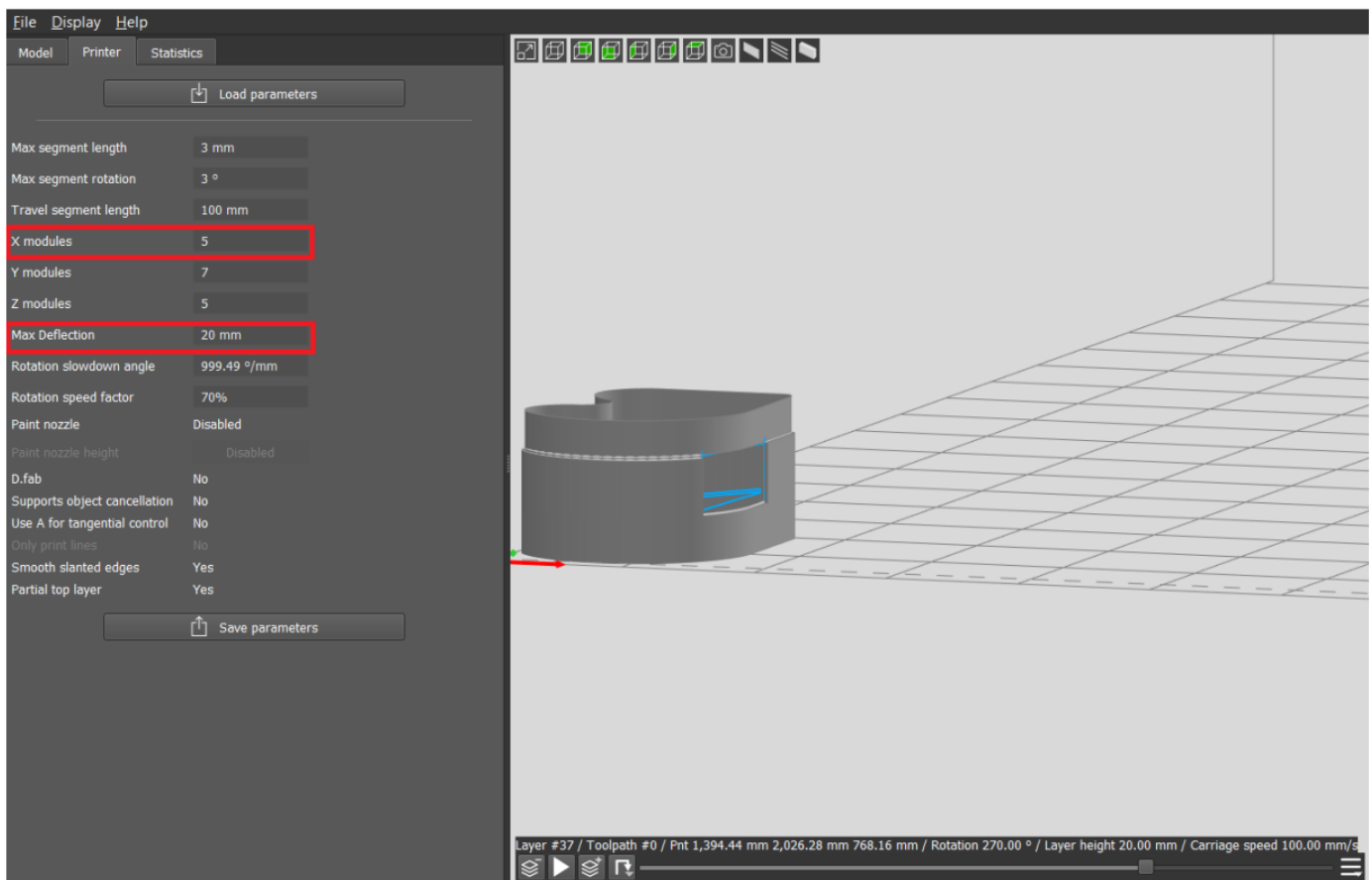


Figure 12: Maximum Deflection.

Once you have entered these values into COBOD Slice, you can examine the correction curve displayed in the Viewport. This curve, shown as a dashed line along the X-axis, illustrates the adjustments that will be made along the Z-axis. The height of the arching line above the X-axis in the animation indicates the extent of compensation needed for the Z-axis coordinates. By following these steps, you can effectively use the sag compensation feature in COBOD Slice to ensure that your large-scale prints are accurate and uniform, irrespective of the truss sag.

4. COBOD 3D Printing: Step-by-Step Checklist

This checklist will guide you through the crucial steps necessary for preparing your CAD file and effectively utilizing COBOD Slice software. By following these steps, you can ensure a seamless and efficient 3D printing process with COBOD printers.

CAD-file Preparation	
Tasks	Status
1. Integrate centerlines within the target CAD model	
2. Validate offset dimensions for compatibility with the selected nozzle and desired wall width	
3. Verify the accuracy of 3D object/building dimensions (e.g., window sizes)	
4. Minimize the number of separate objects in the model	
5. Save the CAD model in a compatible format (.STEP/.STP)	
COBOD Slice: Preparing 3D Models for COBOD Printers	
Tasks	Status
1. Import the CAD file – <i>'Import Centerlines'</i>	
2. Determine and set the appropriate <i>'Layer height'</i>	
3. Configure settings for <i>'Nozzle width'</i> , <i>'Flap length'</i> , <i>'Print speed'</i> , and <i>'Minimum layer time'</i>	
4. Compute the toolpath based on the above settings	
5. Review and refine the print path for optimization	
6. (Optional) Modify toolpaths (Apply textures, seams etc.)	
7. Generate the G-code for the printer	



5. Menus and Settings

5.1 Menus

File

No.	Parameter	Description
1.	Export Toolpath...	Utilize this function to export the toolpath in Step format, which is best suited for smaller models due to its simplicity.
2.	Import Settings From G-Code	Select this option to update all slicer parameters to match those found in the header of the G-Code file. Please note that this function does not import objects or groups. If the G-Code file includes settings for multiple prints or selections, you will need to manually apply the imported settings to each group of objects within your project.
3.	New Project	Initiate a new project within COBOD Slice, similar to its default state upon opening. This creates a clean workspace for starting fresh.
4.	Open Project	Load an existing project file from your computer. Be aware that projects saved with a different version of COBOD Slice might have compatibility issues, and a warning will appear if discrepancies are detected.
5.	Options	Access a range of customizable settings saved between sessions, such as: Graphics: Choose colors for the toolpaths, with options like solid color, layer gradient, or colored sides. Layer gradients validate print order, while colored sides help verify print orientation. Units: Adjust the decimal precision for displayed values. Advanced: Enable additional, often experimental features. These features are under development and may not always function as expected. Locale: Select the language used inside COBOD Slice.
6.	Quit	Close the COBOD Slice software.
7.	Save Project (As...)	COBOD Slice offers the functionality to save the model and parameters in a project file. This feature is useful for sharing the setup or computing toolpaths later. Reopening and computing from a saved project file will produce the same toolpath and G-code as if they were computed before saving. However, it's important to note that project files may vary depending on the version of COBOD Slice used. While all files are compatible across versions, loading a project file saved in a different version might result in missing data, triggering a warning message.
8.	Update License	Update your COBOD Slice software license by selecting and loading a new license file.



Display

No.	Parameter	Description
1.	Show Grid	This toggle switch controls the grid's visibility in the viewport, which is useful for scale and alignment.
2.	Show Move Toolpaths	Enable or disable the display of travel paths (non-printing paths) of the nozzle. Other toolpath lines remain visible regardless of this setting.
3.	Toggle Origin Trihedron	Control the visibility of the colored axes at the viewport's origin, aiding in orientation and model positioning.

Help

No.	Parameter	Description
1.	About COBOD Slice	Check the installed version of COBOD Slice.
2.	Report Bug	Directly report any software issues using your preferred email application, helping to improve future versions.

5.2 Settings

Model tab

No.	Parameter	Description
1.	Additional nozzle settings - Flap length	Determines the length of the flaps on the sides of the nozzle. This length is used to calculate the appropriate height the nozzle should be lifted to when moving across the print, preventing any unintended contact with the printed material.
2.	Additional nozzle settings - Maximum rotation	Enables the setting of a maximum rotation limit for the nozzle. This constraint ensures that the nozzle rotates only within a specified range in each direction, potentially lifting during a toolpath to unwind if necessary. An unlimited setting allows for free rotation of the nozzle, suitable for more complex print paths.
3.	Additional nozzle settings - Offset	This parameter allows users to define the length of their offset nozzle, which in turn influences the printer's operational behavior. With the nozzle offset specified, the printer utilizes rotation and movement along the X-axis, while restricting motion on the Y-axis. This functionality is particularly advantageous when printing facades or similar structures, as it permits the printhead to approach closely to the building surface.
4.	Additional nozzle settings - Nozzle shift	Adjusts the printhead position to account for nozzles that do not deposit material directly beneath them. This offset is crucial for ensuring that printed walls are accurately positioned, especially when the nozzle's deposit point differs from its physical location.



5.	Compute Toolpath	Compute the toolpath according to the defined properties. This button will indicate (flash red) when a computation is necessary, ensuring the print path is always up to date with the latest settings.
6.	Corner extrusion multiplier	Addresses the issue of over-extrusion in corners or areas with significant rotation. Adjusting this setting reduces the material extruded in these specific areas, enhancing print accuracy and structural integrity.
7.	Edit Selection Orientations 	Alters the orientations of selections, reversing their direction in a manner similar to toolpath reversals. This is essential for ensuring the correct application of effects.
8.	Edit Start positions 	Customizes the starting points of toolpaths on closed objects. Users can specify an XY point for each object; the toolpath will initiate at the point nearest to this specified location. If no point is set, the toolpath starts closest to the previous toolpath's end. Points can be reset as needed.
9.	Edit Toolpath Order 	Provides a tool for rearranging the sequence of toolpaths, optimizing print efficiency by reducing travel time. The order can be altered through interactive selections in the viewport or by adjusting the list, with an option to auto-complete unselected objects.
10.	Edit Toolpath Orientations 	Opens a dialog for adjusting the direction of toolpaths. Orientation changes can be made by selecting objects either in the list or directly in the viewport.
11.	External objects	Allows the addition of groups containing external objects. Refer to the External Objects example in the guide for detailed information.
12.	Extra G-Code – Layer selector	This input allows users to write custom G-code scripts to target specific layers of the print job. Users can define conditions to select layers where the extra G-code will be applied. For example, one can program the script to insert extra G-code only on layers 2, 4, and 9, or on every second layer up to layer 20, or even on every layer of the print. This flexibility enables precise control and customization of the printing process on a per-layer basis.
13.	G-Code	The "G-Code" input field is where users enter the G-code commands that they wish to be inserted at the layers defined in the "Extra G-Code – Layer Selector". This could include any specific instructions or modifications they want to apply to those selected layers. The G-code entered here will be executed by the printer at the specified layers, allowing for detailed customization and control over the printing process.
14.	Generate G-code	Compiles and converts the print instructions into G-code, with an option to save the file to a desired location.
15.	Generate Partial G-code	Creates G-code starting from the current nozzle position in the viewport. This function is useful for resuming prints that were previously started.
16.	Import Centerlines	Select and upload a model file from the filesystem in Step format. This file can include wall centerlines, 2D objects in 3D space (also known as shells,



		surfaces, or faces), and external objects as solids. For detailed instructions on preparing this file, refer to the CAD File Preparation section.
17.	Knife - Attached	This checkbox option is used to indicate whether a knife is attached to the nozzle. The knife is employed for cutting printed toolpaths. When checked, it signals the software that a knife cutting feature is in play, enabling appropriate adjustments in the slicing process for accurate and efficient cutting operation.
18.	Knife location	Specifies the X, Y, Z coordinates of the knife's position relative to the nozzle. The coordinates (0, 0, 0) represent the knife being at the center of the nozzle. This setting is crucial for ensuring precise alignment of the knife for accurate cutting, relative to the printed structures.
19.	Knife rotation	Defines the knife's angle of rotation, in degrees, relative to the nozzle. A rotation of 0 degrees means the knife cuts in the same direction as the print path. Adjusting this parameter allows for the knife to cut at different angles, enabling versatile cutting options depending on the requirements of the print job.
20.	Layer height	Defines the thickness of each print layer, typically set between 10 mm and 50 mm, with a standard setting of 20 mm. This parameter is crucial for achieving the desired print quality and object strength.
21.	Lift speed	Determines the speed of the printhead's vertical movement during lifts that occur before and after executing a toolpath. Optimizing this speed can significantly impact overall print efficiency.
22.	Manage groups 	Organize and categorize objects within the model into groups. This feature is essential for applying specific properties to selected walls and utilizing objects for non-printing purposes. For guidance on using this feature, see the Feature guide section for practical examples. Within this menu, create new groups using the 'Add Group' button, manage objects within groups via drag-and-drop, and assign unique names and colors to each group for easy identification and reference in the viewport.
23.	Min layer time	Establishes the minimum duration each layer takes before starting the next layer. Speeds for shorter layers are automatically adjusted to meet this minimum time, ensuring consistent quality. This setting is particularly important as it varies depending on the material properties, affecting the drying or cooling time required for each layer.
24.	Nozzle	Configure settings based on the specific physical characteristics of the nozzle used in the printer. Adjusting these settings ensures optimal material flow and precision in the print process.
25.	Nozzle - Length	Defines the length of the nozzle, assuming a rectangular shape. This measurement is critical for accurately calculating the amount of extrusion, especially when the nozzle orientation changes during printing.
26.	Nozzle - Width	Sets the width of the nozzle. This dimension is essential for precise calculation of the extrusion volume, directly impacting the print quality and consistency.



27.	Print group - Endpoint control	Modifies the start and end points of each toolpath, either shortening or extending them. This is similar in purpose to retraction settings, aiding in precise material placement.
28.	Print group - Group name	Selects the group from which objects are printed. The group name field enables a dropdown menu for easy group selection.
29.	Print group - Max print speed	Caps the printing speed according to the texture. Options include using the default speed (None) or a fixed value to uniformly limit speed across the entire wall.
30.	Print group - Nozzle rotation	Rotates the nozzle according to the texture.
31.	Print group - Position offset	Applies a texture effect to the wall by shifting the printhead laterally based on the texture value.
32.	Print group - Seams	Manages the placement of seams on closed toolpaths, crucial for print aesthetics and structural integrity.
33.	Print speed	Sets the maximum speed for the nozzle while printing objects from a specific group.
34.	Prints	Contains a list of print groups, each with distinct settings. New groups can be added with default settings through the 'Add Group' button. These groups typically require renaming for clarity. Groups can be removed individually for optimal organization.
35.	Retraction - Lower head extrusion	Ensures immediate material availability at the start of a toolpath by extruding a predefined amount of material when lowering the printhead. This prevents delayed material extrusion, which can cause the wall to start printing later than intended.
36.	Retraction - Use retract commands	Incorporates G10/G11 G-codes in the file, which are executed during the printhead's lifting and lowering. These commands control the material retraction and extrusion dynamically, optimizing material flow and preventing issues like stringing or oozing during these transitions.
37.	Seams - Fixed offset	Adjusts the seam placement along the print direction by a specified percentage, providing more control over seam positioning.
38.	Seams - Random offset	Introduces randomness in the starting point of toolpaths, distributing seams unevenly for a more natural look.
39.	Seams - Seam count	Defines the number of seams used. A higher count prevents continuous seams along the entire print, enhancing structural strength and surface finish.
40.	Seams - Seam distance:	Sets the distance between consecutive seams as a percentage of the total path, affecting the print's visual and structural characteristics.
41.	Seams - Spiral Seams	By enabling this checkbox, the software intelligently distributes the seams in a spiraling pattern, moving them gradually from the bottom to the top for



		each object in the selected group. This avoids having all seams line up vertically, leading to a smoother finish and potentially stronger prints.
42.	Selections	Defines non-printed faces drawn alongside printed walls to select a specific region. These selections enable the application of effects to parts of the wall. Parameters include group name, position offset, nozzle rotation, max print speed, and a radius setting that determines the selection's effective range from the wall.
43.	Slicing height bias	Adjusts the slicing plane height temporarily. This helps in fine-tuning intersections within the model for optimal results.
44.	Slicing range	Specifies the vertical (Z-axis) range for slicing, allowing for focused printing on a particular segment of the structure. This feature is particularly useful for managing print sequences and ensuring efficient use of resources.
45.	Transform 	The "Transform" parameter enables precise adjustment of the model's position and orientation within the printing workspace. It facilitates movement along the X and Y axes and rotation around the point in the model's bounding box nearest to the origin. Any transformations applied can be easily reverted to the model's initial state by setting each transformation input back to 0. This ensures that the original layout is always retrievable, providing a secure way to explore various placements and orientations without the risk of losing the original setup.
46.	Travel speed	Sets the speed at which the printhead moves when transitioning between toolpaths. This speed is key to maintaining efficient print times while ensuring accuracy.
47.	Vase mode - Enabled	Converts the current model into a vase print, where the printer spirals upwards continuously instead of printing in discrete layers. This mode eliminates travel moves but is applicable only for printing a single, closed surface.

Textures are versatile tools, applicable under both the 'Print' and 'Selections' parameter groups. They are employed to create diverse effects on specific print objects, with these effects tied to the texture's colors. Users define the effects of pure white and black in the texture, and the software interpolates effects for other colors based on these settings, allowing for a nuanced application of textures.

These textures can be stretched over the entire object or tiled by setting the 'repeat' flag and defining the tiling dimensions. Users also have the option to offset textures for precise positioning. Notably, textures can influence three key parameters: Position Offset, where the texture alters the toolpath positions; Extrusion Override, modifying extrusion based on the texture; and Nozzle Rotation, affecting the rotation according to the texture. This integration offers a high degree of customization in the appearance and functionality of the printed object, with six distinct texture types available for varied visual and practical effects.



No.	Parameter	Description
1.	Disabled	This setting deactivates the texture effect on the selected objects, resulting in no additional visual impact.
2.	Fixed value	Applies a uniform effect across the object, similar to using a texture of a single, consistent color. This effect is also user-defined.
3.	Horizontal gradient	Uses a texture with a horizontal gradient, creating a linear variation in effect from one side to the other. The effect remains constant in the vertical direction.
4.	Image	Allows for the selection of a specific image from the file system to be used as a texture. This provides a broad range of personalized effects.
5.	Perlin noise	Generates an effect using an infinite 3D texture created through Perlin noise, yielding a unique and naturally random pattern.
6.	Vertical gradient	Employs a texture with a vertical gradient, offering a linear variation in effect from top to bottom. The effect is consistent across the horizontal aspect.

Printer tab

No.	Parameter	Description
1.	D.fab	Checking the "D.fab" box indicates the use of the D.fab concrete mixture. The software then activates specific alerts related to this mixture, monitoring your settings to ensure adherence to the recommended layer time, vertical building rate, and flow rate for D.fab.
2.	Max deflection	This setting accounts for potential sagging or deflection, particularly in the X-axis between supports. By inputting the maximum expected deflection, the software adjusts the Z-axis coordinates to compensate, ensuring the print remains accurate despite any physical deviations, see the Feature guide section for further detail.
3.	Max segment length	Sets the length of each G-code segment during printing. It's recommended to keep this at the default setting for a smooth printing experience.
4.	Max segment rotation	Limits the maximum rotation between segments, ensuring smooth transitions and print quality. Default settings are typically optimal.
5.	Only print lines	When enabled, the software understands the model to be composed of independent lines rather than surfaces. It prepares the final G-code to direct the printer along these specific lines, ideal for non-planar printing where the focus is not restricted to flat, horizontal layers.
6.	Paint nozzle	The Paint nozzle option is tailored for outlining the first layer of a building, allowing the printer to trace the model's perimeter without lifting on the Z-axis. Ideal for pre-print testing, this setting uses a paint nozzle to create either dashed or solid lines, offering a visual representation of the model's



		outline for accuracy checks before the actual printing process begins. The Paint nozzle can also be combined with line printing.
7.	Paint nozzle height	This setting adjusts the distance between the paint nozzle and the printing surface, directly affecting the thickness of the painted line. A crucial parameter for pre-print testing, it enables finetuning of the line width for clear and precise outlines of the model, providing an accurate visual guide for the final print.
8.	Partial top layer	When this is checked, the software scans for model sections that might be skipped due to their placement between layers. It ensures these parts are printed, even if they do not perfectly align with a standard layer height.
9.	Rotation slowdown Angle	This parameter sets the angle at which the printer's tangential motor begins to decelerate, measured in degrees. Adjusting this angle allows for finer control over the printer's movement, especially in complex or detailed sections of a print. It's essential for balancing speed and precision, ensuring smoother transitions and improved accuracy in the printed output.
10.	Rotation speed factor	This parameter adjusts the speed factor applied when the printer turns more sharply than the predefined Rotation Slowdown Angle. It's essential for controlling the printer's speed during tight or complex turns, ensuring precision and stability in the printed structure, particularly in intricate or challenging segments.
11.	Smooth slanted edges	Activating this feature makes the software attentive to slanted edges within the model. It adapts the printing strategy in these areas by varying height and extrusion rate, filling jagged sections for smoother edge printing, closely aligning with the intended design.
12.	Supports object cancellation	Enables inputting object names before printing, allowing for the cancellation of individual objects during test runs.
13.	Travel segment length	Determines the length of G-code segments when the printer head travels between walls. Shorter segments allow for smoother stops and starts.
14.	Use A for tangential control	This option switches the control command in G-code from 'U' to 'A' for managing tangential movements. This change can enhance the smoothness of prints on certain firmware versions. It's important to use this setting only if your printer is specifically configured for it.
15.	X/Y/Z modules	Specifies the printer's dimensions in terms of modules, defining the grid size. COBOD Slice alerts the user if the model is placed outside this printable area.



Statistics tab

No.	Parameter	Description
1.	Average layer time	Represents the average duration required to print each layer.
2.	Estimated concrete volume	Indicates the total volume of concrete required for the print. This value can vary by 2-5% when using flaps, and up to 50% when not using flaps, due to differences in material characteristics.
3.	Estimated duration	Provides an estimated time for the complete print. This estimate can be off by 10-15% compared to actual print time. For project planning, consider adding an extra 15% to this time for a more realistic duration estimate.
4.	First layer Z	Displays the initial height of the printhead above the foundation for the first layer.
5.	Last layer Z	Shows the height of the printhead above the foundation for the final layer.
6.	Layer count	Represents the total number of layers in the print.
7.	Max. layer time	Shows the longest time it takes to print a complete layer.
8.	Min. layer time	Indicates the shortest time needed to print a complete layer.
9.	Printer	Select your printer model. This selection is used to determine the boundaries of the printable area within the slicer.
10.	Print layer statistics	Provides a breakdown of statistics, calculated for each individual layer.
11.	Print length	Calculated as the total distance of the path that will be printed.
12.	Rapid length	Accounts for the total distance of non-printing paths in the entire print.
13.	Total length	Measures the combined distance of printing and movement the printer will undertake during the entire print process.

