





### **Erasmus+ strategic partnership for Higher Education**

**BOOSTING THE SCIENTIFIC EXCELLENCE AND INNOVATION** 

CAPACITY OF **3D** PRINTING METHODS IN PANDEMIC PERIOD

# e -TOOLKIT 3 FIXATOR MADE BY STEREOLITHOGRAPH

## (Digital light processing method)

Project Title	Boosting the scientific excellence and innovation capacity of 3D printing methods in pandemic period 2020-1-RO01-KA226-HE-095517
Output	O2 – BRIGHT e-toolkit manual for digital learning in producing medical parts by 3D printing methods in the context of the pandemic
Toolkit	e-Toolkit 3 Fixator made by Stereolithography (Digital light processing method)
Date of Delivery	November 2021
Authors	Aleksandar Miltenović, Milan Banić, Nikola Vitković, Miloš Simonović
Version	Final variant







#### Content

1	Introduction	3
2	Stereolithography process	3
3	Generating geometry and preparation for printing	4
4.	Materialise Magics	7
5.	3D printing	29
6.	Postprocessing	32
7.	Conclusions	35







#### 1 Introduction

In orthopedic surgery, it is vital to use proper fixation techniques to treat various medical conditions. Here is a requirement to provide the best possible medical treatment to a patient with a bone fracture. Surgeons use internal and external fixation techniques to treat bone fractures.

Nowadays, one of two types of plates and their variants are commonly used for bone fixation is Locking Compression Plates (LCP). These fixation systems are standardly anatomically shaped, and they provide angular stability to the bone.

In this toolkit will be shown printing process with all necessary pre- and postprocessing steps as well as machine settings for successful printing of the part – Locking Compression Plates which fixation plate.

#### 2. Stereolithography Process

Stereolithography, as 3D printing technology, has following steps in the

- Selection of technology and machine
- Generating 3D model in a software for 3D modelling
- Generating STL file
- Defining parameter of machine for printing (at first use)
- Optional correction of object geometry
- Object positioning
- Generating support
- Distribution of model with support at platform for printing
- 3D printing
- Postprocessing

In a similar way, the steps required for modelling of the medical part is going to be presented. Details presented must be just enough for the readers so they can also replicate it at their home institution following the procedure described in the toolkit manual.

Standard for 3D printing is STL file that needs to be generated. Most of used CAD software (Solidworks, Catia, Inventor) has number of restrictions in work with STL files and therefor is







necessary using of specialized software for STL file processing. One of those software that can be used for stereolithography is Materialise Magics.

Options that are important for conversion are related for resolution. Most of software are giving button option with high, medium and low resolution as well as options that user can enter his tolerances. As the user want higher resolution and better surfaces, he should choose lower tolerances for possible deviations. This is especially important for the partswith surfaces that are not plane and under angle. As the tolerances are lower the final STLfile will be higher. Also, in the cases when printing resolution is low, high STL file resolution isnot going to get any result. Therefor is important to know the resolution of the printer. For example, Envisiontec Ultra 3SP has the maximal resolution of 0.025 mm in z direction.

Material consumption is an important issue for parts made by Stereolithography printing process. If the functionality of the part as well as strength is less important, there should be less used material. In that case for stereolithography is important to define the model as hollow and to define technological holes if this is necessary. Preprocessing can be done in 3D modeling software that can be, is some cases, easier comparing with software for manipulation with STL file.

#### 3. Generating geometry and preparation for printing

Part that need to be printed has to be made in some of CAD software for 3D modeling. After the modeling is finished is necessary to convert part into STL file. Today all the software has possibility to convert file into STL (Figure 3. 1 – Autodesk Inventor).







🔚 Save Copy As		<b>— X</b>	STL File Save As Options	
Content Center Files	Autodesk Inventor Parts (* jpt) Autodesk UnWS Files (* dwg) (AutoCAD DWS Files (* dwg) CATIA VS Part Files (* CATPart) DWF Files (* dwf) DWF Files (* dwf) GES Files (* jgt) (* GES Files (* jgt) JPEG Files (* jgt) JPEG Files (* jgt) PDF Files (* jgt) PDF Files (* jgt) PATsalid Bimary Files (* x, b) Parasold Bimary (* x, b)	nodified T <sub>3</sub> 2015 02:40 A	Format Binary Units millimeter Resolution Bigh Low Surface Deviation: 0,001700 Normal Deviation: 10 Max Edge Length: 33,91161 Aspect Ratio: 21,50000	0% 100% 0% 100% 50 0% 100%
	Preview Options Sa	ve Cancel	Allow to Move Internal Mesh Node	s V Export Colors

Figure 3.1. Autodesk Inventor windows for converting in STL with possible options

Wall thickness is important for printing process while if the wall dimension is too small there is dangerous that during printing or in postprocessing phase wall can have or got cracks. Some tips for wall thickness is to be at least 1 mm but results will be better if it is 2 mm. Also here should be taken into account the size of the wall and is edge of surface with thickend or not.

Technological holes should be defined for leakage of liquid material. The tip is that the smallest diameter of hole should be 2 mm, but it would be better to have more holes and that diameter is 3 mm. For this is important also to define the logical position of the hole at the part. Position should be at surface that is not important for the part functionality and that will allow liquid material to leak out (Figure 3.2, 3.3, 3.4).







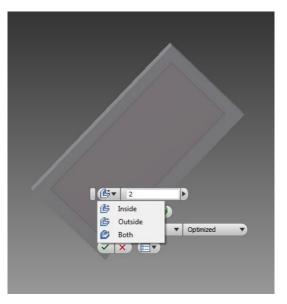


Figure 3.2. Defining hollow and position for technological hole

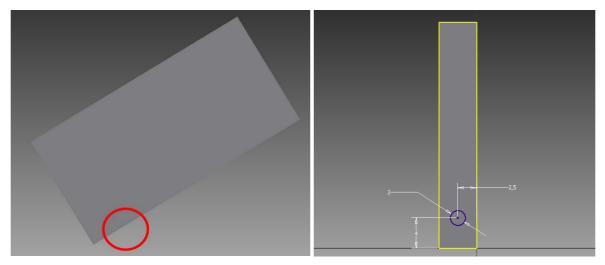


Figure 3.3. Position for technological hole







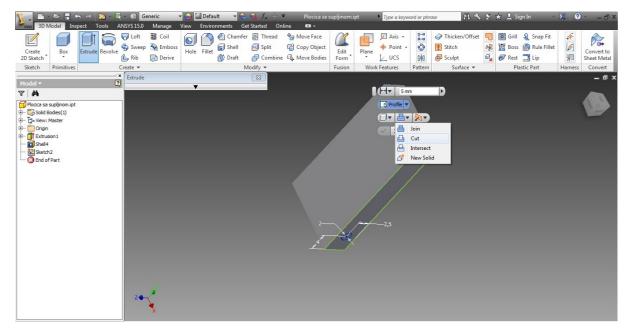


Figure 3.4. Definition of technological hole in CAD software

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Page | 7





#### 4. Materialise Magics

For the good printing of the part is important to define the machine settings. Materialise Magics offers a lot of parameters that need to be defined in order to have good print. Therefor in Figures 4.5 - 4.43 is going to be presenting defining settings step by step. This isespecially important for support settings that enables the good connection to basic platform from one side and to the printed part on other side. This gives smooth postprocessing in which part with support structure need to be separated from platform as well separation of printed part from support.

💋 Untitled - Magics 16.0				
File Edit View Position Fixing Tools	Scenes Build preparation Export Options H	lelp		
<u>}</u>	Create Scene from Modeler Scene Add Part to Scene New Scene	Tools Roong View Marking Scenes S	ilicing RM Slicer e-Tools Support Generation To	coling e-RP Objet
	Copy Scene Unload Scene Change Machine Change Machine Machine Roporties Machine Romany Update mmd-files		ર્ચ	Vew Bloss C X Vew Sloss MultiSecton Grd Support Vew Rapet Part Rapes 2 - X Part Layer Part Fung Information Part e Scenes Part Name Next Dimented Nomals Dimented Nomals Disc Edges
				Bed Contours
			X	Attendation Pages  Text Drawing   Attachments   Textures Heasurement Pages Datarce Rakin, Jargle Jafo Report Fire Pages
0 1	2 3	4 5	6 mm	Autofix Basic Hole Triangle Shell Overlap Point

Figure 4.5 Surrounding in Materialise Magics

Figure 4.5 represent Surrounding in Materialise Magics. To access Machine Library is necessary to use card Scenes. After clicking Machine Library is necessary to use Envisiontec Prefactory as it is shown at Figure 4.7.

Machine Library	Add Machines from Library	×
My Machines	Machine Library	My Machines
(No Machine) Envisionte: Perfactory (mm) Copy Machine Profile	B: □         Aspect           B: □         Bein Ymhua           B: □         Cricept Laser           B: □         Cricept Laser	(No Machine)
Edit Parameters           Add To Default View	Constant Section (mm)	1
Number of Default Scenes	LINK-BOX_LB-3112_(mm) LINK-BOX_LB-3122_(mm)	
	My Machines folder C:\ProgramData\Waterialise\Wagics\Wy Mac	hines
Close Help //		Close Help

Figure 4.6. Introduction of Envisiontec Prefactory







Machine Library	Machine Library
My Machines       Add from Library         Envisiontec Perfactory (mm)       Envisiontec Perfactory (mm)         Copy Machine       Envisiontec Perfactory (mm)         Envisiontec Ultra 3SP (mm)       OK         Cancel       s         1	My Machines       Add from Library         Envisiontec Perfactory (mm)       Envisiontec Ultra 3SP (mm)         Copy Machine Profile       Delete Machine Profile         Delete Machine Profile       Edit Parameters         Add To Default View       Number of Default Scenes         1
Close Help	Close Help //

Figure 4.7. Defining 3D printer into Materilise Magics

In Figure 4.7 is shown procedure in which is copied "Evisiontec Perfactory" and changed in the name of 3D printer that is used for printing. In this case is 3D printer "Envisiontec Ultra 3SP" and that is the name used for defining work environment. In Figure 4.8 is given introducing field for Envisiontec Ultra 3SP environment.

Machine Properties : Envisiontec Ultra 3SP (mm				×
Machine Properties : Envisiontec Ultra 3SP (mm Machine information Platform Z Compensation BuildCreator Module Support parameters Build time estimation Cost estimation Cost estimation Export to machine	n) Machine information Machine name Material name Comment	Envisiontec Ultra 3SP (mm) Photopolymer none		
Save changes in:				
Active platform scene I All platform scenes alike	Machine library		OK Cancel Apply	Help

Figure 4.8. Introducing machine settings – machine information







Machine Properties : Envisiontec Ultra 3SP (mm	ר)							<b>X</b>
Machine information Platform Build envelope Default part position Platform position	Build envelope Platform shape							
Nesting Wall Thickness Fields No-Build Zones Z Compensation BuildCreator Module Support parameters Build time estimation Cost estimation Export to machine	Size x (width) Size y (depth) Size z (height)	160,000 n	nm nm nm	Rescaled 260,000 160,000 220,000	mm mm mm			
Save changes in:								
Active platform scene II All platform scenes alike	Machine library				ОК	Cancel	Apply	Help

Figure 4.9. Introducing machine settings – platform

In Figure 4.9 are given machine settings for the platform. It has box shape with size 260x160x220mm. In Figure 4.10 is defined default part position for the position of the printingpart on platform.

· · · · · · · · · · · · · · · · · · ·								
Machine Properties : Envisiontec Ultra 3SP (mm)								
Machine information	Default part position							
🔁 Platform	Minimum x	1						
Build envelope			mm					
Default part position	Minimum y	1	mm					
Platform position	Minimum z	8	mm					
Nesting								
Wall Thickness								
Fields								
No-Build Zones								
Z Compensation								
BuildCreator Module								
Support parameters								
Build time estimation								
Cost estimation								
Export to machine								
Save changes in:								
Active platform scene All platform scenes alike	Machine library			ОК	Cancel	Apply	Help	

Figure 4.10. Introducing machine settings – default position







Machine Properties : Envisiontec Ultra 3SP (mn	ו)							<b>—</b>
Machine information	Z Compensation							
Z Compensation     BuildCreator Module	Default Value	0,125	mm					
Support parameters Build time estimation	Triangle I							
Cost estimation Export to machine	Point Bas	re minimal z-t æd	hickness	0,0010	mm			
	Remov	ve Self-Inters	ections					
			value to part	name				
	Use Angl	e based Core	ction factor x 0.125 =	0.125	mm			
	15°	0,7400	x 0.125 =	0.0925	mm			
	30°	0,5000	x 0.125 =	0.0625	mm			
	45°	0,2930	x 0.125 =		mm			
	60° 75°	0,0340	x 0.125 = x 0.125 =	0.0167	mm mm			
	90°	0,0000	x 0.125 =	0	mm			
	V Filter sha	rp triangles						
Save changes in:								
Active platform scene All platform scenes alike	Machine librar	y			ОК	Cancel	Apply He	ip )/

Figure 4.11. Introducing machine settings – platform, z Compensation

In Figure 4.11 is defined z-compensation for the platform – 0.125mm. In Figure 4.12 is defined support format that can be the same as printing part or different. For the successful printing is necessary that the printing part and support has to be entered as two files but with same names.

-					
III Machine Properties : Envisiontec Ultra 3SP (mm	1)				<b>—</b> ×
Machine information	Support Format				
Platform	Solid supports:				
Z Compensation	Joild Jupports.				
BuildCreator Module	Keep as stl on exi	t I	filename	s_*_ex.ext	<b>v</b>
C Support parameters					
🔁 General	Merge with part o	n exit			
i Support Format	Non-solid supports:				
Surface selection					
Type selection	Keep as stl on exi	t I	filename	s_*.ext	•
Common	Merge with part o	n evit			
C Point		(Texic			
🚞 Line	Thickness	0,000	mm		
Line*	Apply stitch				
🔁 Web	Apply such				
Block	Apply triangle reduction	n			
Contour					
Gusset	Apply unify (will be don	e before merging the s	solid supports)		
Combi					
Cones					
Build time estimation					
Cost estimation					
Export to machine					
Export to machine					
Save changes in:					
Active platform scene III All platform scenes alike	Machine library		ОК	Cancel	Apply Help

Figure 4.12. Introducing machine settings – support format







🗈 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPORTS				83
Machine information Platform 2 Compensation 3 Support parameters 3 Support format 3 Surface selection 3 Surface selection 3 Common 4 Point 5 Common 5 Doint 6 Common 6 Doint 1 Dire 5 Unice 5 Combi 5 Dontur 5 Combi 5 Combi 5 Combi 5 Combi 5 Combi 5 Combi 5 Contour 5 Guist 5 Combi 5 Co	Surface angle Selection angle This angle determines is support generation. If the angle is below th above this value the a: self-supporting and sup self-supporting and sup	is value, supp Irface is consi	orts are generated; dered to be	70° 45° 30° 15°	
Active platform scene All platform scenes alike	🔽 Machine library			OK Cancel Apply Hel	P ,

Figure 4.13. Introducing machine settings – surface angle

In Figure 4.13 is defined surface angle in which support will be generated on the part.

In this case will be used 35 degrees. In Figure 4.14 is defined surface filter and surface angle.

Machine Properties : Envisiontec Ultra 3SP (mm	)						×
Machine information Platform Z Compensation BuildCreator Module Support parameters General Support Format Support Format Suface selection	) Surface filter Unconditional si Sharp edge filter Maximum height V Automerge surface	0.3 mm 10 mm	2				
Surface angle Surface filter Type selection Common Line Line Solution Solution Solution Contour Combi Volume Combi Solution Cost estimation Cost estimation Cost estimation	<ul> <li>Platform support or</li> <li>Keep support or</li> <li>Keep support or</li> <li>Keep individual</li> <li>Keep individual</li> </ul>		ntact platform contact				
Save changes in: Active platform scene All platform scenes alike	Machine library			ОК	Cancel	Apply	Help

Figure 4.14. Introducing machine settings – surface filter

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Page | 12





Machine Properties : Envisiontec Ultra 3SP (million)	m)	×
Machine information	Support types	
Platform	© None	
Z Compensation	Non-solid	
BuildCreator Module	Point	
🔁 Support parameters	Point*	
🔁 General	🔽 Line	
Support Format	✓ Line*	
Surface selection	V Block	
Type selection	Contour Web	
ight Support types	Gusset	
Point supports	Combi	
Line supports	O Volume	
Line* supports	© Cones	
Gussets	Cones	
Common		
Point		
Line		
Line*		
Block		
Contour		
Gusset		
Combi		
Volume		
Cones		
Build time estimation		
Cost estimation		
Export to machine		
Save changes in:	]	
Active platform scene I All platform scenes alike	Machine library	OK Cancel Apply Help

Figure 4.15. Introducing machine settings – support types

In Figure 4.15 is defined surface angle in which support type. In Figure 4.16 is definedbasic parameter for support – gusset.

Machine Properties : Envisiontec Ultra 3SP (mm	1)				×
Machine information	Gussets				
Platform					
Z Compensation	Maximum distance to wall	10	mm		
BuildCreator Module	Minimum surface height	80	mm		
🔁 Support parameters					
General					
Support Format					
Surface selection					
C Type selection					
Support types					
Point supports					
Line supports					
Line* supports					
Gussets					
Common					
C Point					
🔁 Line					
🗀 Line*					
🚞 Web					
Block					
Contour					
Gusset					
Combi					
Volume					
Cones					
Build time estimation Cost estimation					
Export to machine					
Save changes in:					
Active platform scene I All platform scenes alike	Machine library			OK Cancel	Apply Help

Figure 4.16. Introducing machine settings – gussets







Z Compensation       VX Offset (a)       U-3       mm         Support parameters       The XY offset detamons but datace between the edge of the part and the border of the support.       The XY offset detamons but datace between the edge of the part and the border of the support.         Common       Vertical well offset       The XY offset detamons but datace between the edge of the part and the border of the support.         Common       Vertical well offset       The XY offset detamons but detamons but were the edge of the part and the border of the support.         Local Minima       The XY offset detamons but detamons but were the edge of the part and the border of the support.         Text Synchronization       Broads         Broads       Solid Border         Point       The Y         Line       Line         Verbau       Block         Contour       Guisset         Guisset       Contoil         Cones       Eport to machine	🛯 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPORTS		<b>×</b>
Z Compensation     VX Offset (a)     U-3     mm       Support parameters     The XY offset detamons but distance between the edge of the part and the border of the support.     The XY offset detamons but distance between the edge of the part and the border of the support.       Common     Vertical wall offset     Lower time       Local Minima     The XY offset detamons but distance between the edge of       Text of first     Lower time       Local Minima     The XY offset detamons but distance between the edge of       Text of Synchronization     Broaden support       Broaden support     Filter Synchronization       Broaden     Dinit       Line     Line       Unite     Line       Solid Border     Givent       Guiset     Guiset       Contour     Guiset       Guiset     Contour       Guiset     Contour       Guiset     Contour       Guiset     Contour       Consi     Eport to machine		XY offset		
Z Compensation Support parameters General Common Vorified Z Offset Vertical wall offset Local Minima Teeth at platform Teeth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Point Line* Veb Block Contour G Gusset Export to machine Export to machine	🚞 Platform	XX Offset (a)	0.8 mm	
General     G				a
General Common		the part and the border of the	distance between the edge of ie support.	
Vortise     Z offset     X offset     X offset     X offset     Verical wall offset     Lowest line     Load Minima     Teeth stplatform     Teeth Synchronization     Broaden support     Reinforcement Line     Filter Segments     Solid Border     Point     Line     Line     Line     Line     Line     Lose     Solid Border     Contour     Gusset     Contour     Gusset     Eport to machine     ave changes in:				
Z offsets No support offset Vertical wall offset Lowest line Local Minima Teeth at platform Teeth synchronization Broaden support Reinforcement Line Filter Segments Solid Border Point Line Line Line Contour G susset Contour G susset Export to machine ave changes int				
No support offset Vertical wall offset Lower time Local Minima Teeth at platform Teeth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Doint Line Line Line Block Block Block Contour Gusset Combi Cornes Export to machine				$\checkmark$
Vertical wall offset Lowest line Local Minima Teeth at platform Teeth spinetrom Broaden support Reinforcement Line Filter Segments Solid Border Point Line Line Line Dine Block Contour Gusset Contour Gusset Export to machine ave changes in:				
Lowest line Local Minima Teeth Sphotrom Teeth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Dine Line Line Line Dine Block Contour Guisset Contour Guisset Export to machine ave changes in:				
Local Minima Teth at platform Teth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Point Line Line Block Gontour Guszet Gonzer Export to machine ave changes in:				
Teth at platform Teth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Point Line Line Line Contour Gusset Contour Gusset Export to machine ave changes in:				
Teeth Synchronization Broaden support Reinforcement Line Filter Segments Solid Border Deint Line Line Line Dide Block Contour Gusset Contour Gusset Export to machine ave changes in:				
Broaden support   Reinforcement Line   Filter Segments   Solid Border   Point   Line   Line*   Block   Contour   Block   Contour   Gusset   Cornes   Export to machine				
Reinforcement Line   Filter Segments   Solid Border   Point   Line*   Use   Block   Contour   Gusset   Combi   Cones   Export to machine				
Filter Segments Solid Border Point Line Line* Web Block Contour Gusset Combi Combi Comes Export to machine ave changes in:				
Solid Border  Point Line Line Kontour Solid Sorder Solid Border Line Line Line* Solid Soli				
Point Line Line Subset Combi Combi Export to machine ave changes in:				
Line Line Line Web Block Contour Gusset Combi Comes Export to machine ave changes in:				
Line*				
Web Block Contour Gusset Combi Combi Combi Export to machine ave changes in:				
Block Contour Gusset Combi Combi Cones Export to machine ave changes in:				
Contour Constant Con				
Gusset Combi Consi Feport to machine ave changes in:				
Combi Cones Export to machine ave changes in:				
Cones  Export to machine ave changes in:				
ave changes in:				
ave changes in:				
	export to machine			
Active platform scene 🗌 All platform scenes alike 💟 Machine library	Save changes in:			
	Active platform scene 🔲 All platform scenes alike	Machine library		OK Cancel Apply Help

Figure 4.17. Introducing machine settings – XY offset

In Figure 4.17 is defined xy offset for generation of support structure. In Figure 4.18 is defined z offset parameter that has upper and lower value.

Machine Properties : 9-17-11 TS48 ULTRA AL M	IODIFIED NEW SUPPORTS						×
Machine information	Z offsets						
Platform							
Z Compensation	Upper Z Offset	0.300	mm	· · ·		n n n	
Support parameters	Lower Z Offset	0.300	mm	- b	1		
General				1			
Common	These 2 values detern	nine the dis	tance between the top or the	10 A 1			
XY offset	bottom of the support	and their i	espective surfaces.	, A			
T offsets				k	A		
No support offset	Positive values ensure	the suppo	rt penetrates the part. This is t the support to the part.			<u></u>	1 T
Vertical wall offset	recommended to prop	eny conne	t the support to the part.				i i t
Lowest line						1	
Local Minima	Using an Upper Z Offs support penetrates do	et of 0.250 wonfacing (	) mm will make sure the				
	support period ates at	whitedding :	diraces.			- / V ~	
Teeth at platform							
Teeth Synchronization							
Broaden support							Y
Reinforcement Line							
Filter Segments							
Solid Border							
Point .							
🗀 Line							
🗀 Line*							
🗀 Web							
🚍 Block							
Contour							
Gusset							
🗀 Combi							
Cones							
🗀 Export to machine							
Save changes in:							
Active platform scene 📃 All platform scenes alike	Machine library				DK Canc	el Apply	Help

Figure 4.18. Introducing machine settings – Z offset







🖪 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPORTS						×
Machine information	No support offset						
Platform		0.5					
Z Compensation	No Support Offset	0.5	mm		-0		
C Support parameters	Overhangs less than this value	will not be su	pported. Also, a		Overhane	, <u> </u>	$\sim$
🧰 General	support is generated only when the Minimum Height Supporting		ht is greater than		ON S Y	( B	
🔁 Common	the Parameter regit Supporting	Wall Value.		1			
XY offset	Overhangs less than this offset	will not be su	pported.				
Z offsets					B		
No support offset Vertical wall offset	Minimum Height Supporting Wall (a)	0.5	mm				
Lowest line	A support will only be generated		all baraba ta				
Local Minima	greater than the Minimum Heigh	s when the w it Supporting	air neight is Wall.		-a		
Teeth at platform							
Teeth Synchronization							
Broaden support							
Reinforcement Line							
Filter Segments							
Solid Border							
🗀 Point							
🗀 Line							
Line*							
🗀 Web							
Block							
Contour							
Gusset							
Combi							
Cones							
Export to machine							
Save changes in:							
Active platform scene 🗌 All platform scenes alke	Machine library				OK Cancel	Apply	Help

Figure 4.19. Introducing machine settings – No support offset

In Figure 4.19 is defined no support offset with minimum height supporting wall value.

In Figure 4.20 is defined vertical wall offset value.

Machine Properties : 9-17-11 TS48 ULTRA AL N	AODIFIED NEW SUPPPORTS				8
Machine information	Vertical wall offset				
Platform					
Z Compensation	Vertical Wall Offset (a)	0.1	mm		
C Support parameters	This feature ensures that supports of	ion't get placed	ion a		
🗀 General	vertical wall. A small gap allows the removed.	upport to be e	asily	a,	
Common 🔁	removed.			۳	
XY offset				$\mathbf{X}_{\mathbf{r}}$	
Z offsets				×	
No support offset					
Vertical wall offset					
Lowest line					
Local Minima					
Teeth at platform					
Teeth Synchronization					
Broaden support					
Reinforcement Line					
Filter Segments					
Solid Border					
Point Cont					
Line					
Line*					
Block					
Contour					
Gusset					
Combi					
Cones					
Export to machine					
Save changes in:					
Active platform scene All platform scenes alike	Machine library			OK Cancel Apply H	lelp

Figure 4.20. Introducing machine settings – Vertical wall offset







Machine Properties : Envisiontec Ultra 3SP (	mr	n)
Machine information		Local Minima
Platform		Adjust Hatching
Z Compensation		
BuildCreator Module		Add Point Supports
Support parameters		Align with Hatching
General		
Common		
XY offset		
Z offsets		
No support offset		
Vertical wall offset		
Lowest line		
🖝 Local Minima	=	
Teeth at platform		
Teeth Synchronization		
Reinforcement Line		
Filter Segments		
Solid Border		
Angled EOSTYLE		
Draft EOSTYLE		
Radius EOSTYLE		
Gap EOSTYLE		
Gusset EOSTYLE		
Gusset EOSTYLE Reinforced		
Gusset EOSTYLE Teeth		
Gusset EOSTYLE Teeth EOSTYLE		
🚞 Point		
🚞 Line		
Line*		
🗀 Web	÷	
Block	Ŧ	
Save changes in:		
Active platform scene All platform scenes al	like	Machine library OK Cancel Apply Help

Figure 4.21. Introducing machine settings – local minima

In Figure 4.21 is defined local minima for support. In Figure 4.22 is defined teeth atplatform that can go directly of platform or it can be defined with some value.

Machine information	<ul> <li>Teeth at platform</li> </ul>					
Platform	This function create	e konth at the he	them of a summark			
Z Compensation	only if the bottom is	s on the platform	. This creates			
Support parameters	supports that are m	ore easily remov	ed from the platform		~	
General						
Common	Teeth at platform	n				
XY offset						
Z offsets	Solid (a)	2	mm			
No support offset	When the d	heckbox is off. th	ne "Solid" data box	Aren	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Vertical wall offset	determines -	a height from the	e platform that will be	CVVV	A A A A A A A A A A A A A A A A A A A	
Lowest line	solid (non-p	erforated) suppo n using perforate	ort material. This only ad supports	1 A 1		
Local Minima	applies with	n asing perforate	sa sappora.			
Teeth at platform	Neto, This p	aramatar has ar	iority over the "Solid			
Teeth Synchronization	Height" para	ameter found in t	the Perforations			
Broaden support	menus (Figu	ire 1) if it is large	r than the Solid Height		<b>1</b>	
Beinforcement Line	parameter.					
Filter Segments						
Solid Border						
Point						
Line						
Line*						
Web						
Block						
Contour						
Gusset						
Combi						
Cones						
Export to machine						

Figure 4.22. Introducing machine settings – Teeth at platform







🖪 Machine Properties : 9-17-11 TS48 ULTRA AL MO	ODIFIED NEW SUPPPORT:	s		
Machine information	Contact length			
Z Compensation	Minimum Rib Length (a)	1	mm	
Support parameters General	Maximum Contact Length (b)	1	mm	
General		0	mm^2	
Ca Point	Angle (c)	75	٠	c
Contact length Sunken ribs	Vertical Distance (d)		1 mm	d
Teeth	vertical Distance (d)	0	]	
Reinforced				
Number of Ribs				a
🗀 Line 🗀 Line*				
Web				
🛅 Block				
Contour				
Gusset				
Combi				
Export to machine				
Save changes in:				
Active platform scene 🔲 All platform scenes alike	Machine library			OK Cancel Apply Help

Figure 4.23. Introducing machine settings – Contact length

In Figure 4.23 is defined contact length of support structure. In Figure 4.24 is definedbasic parameter for support – gusset.

Machine Properties : 9-17-11 TS48 ULTRA AL M	IODIFIED NEW SUPPPORTS		<b>—</b>
Machine Properties : 9-17-11 TS48 ULTRA AL M Machine information Platform Z Compensation General Common Point Contact length Sunken ribs Feriforced Number of Ribs Line Line Block Contact Contact Sunken ribs Feriforced Sunken ribs Contact length Sunken ribs Contact length Sunken ribs Contact length Sunken ribs Contact	ODIFIED NEW SUPPORTS Teeth Height (a) Top Length (b) Base Length (c) Base Interval (d) Lower teeth are created if suppor surface. If support leans on a plat	Lower 2 mm 1 mm 1 mm 1 mm C t leans on an upfacing trom, no teeth are created	a d b
Combi Cones Export to machine Save changes in:	T Muchine Brown		DK Cancel Apply Heb
Active platform scene All platform scenes alike	Machine library		UK Cancel Apply Help

Figure 4.24. Introducing machine settings – Teeth







🛄 Machine Properties : 9-17-11 TS48 ULTRA AL MO	DIFIED NEW SUPPPORTS
Machine information Platform Z Compensation General Contact length Support parameters Point Contact length Sunken ribs Teeth Reinforced Furnhere of Ribs Line Line* Web Block Contour Gusset Combui Conts Export to machine	Number of Ribs 80 Define the number of ribs that make up the Point support This support has 3 ribs
Save changes in: Active platform scene 📃 All platform scenes alike	Machine library  OK Cancel Apply Help

Figure 4.25. Introducing machine settings – number of ribs

In Figure 4.25 is defined number of ribs that are generated on support structure. In Figure 4.26 is defined minimum rib length and maximum contact length.

💷 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPORTS		<b>X</b>
Machine Properties : 9-17-11 TS48 ULTRA AL M Machine information Machine information Compensation General Common Point Conso line length Cross line interval Sunken Cross Lines Perforations Teeth Cross line teeth Reinforced Line* Block Contour Gusset Combi Cones Export to machine	ODIFIED NEW SUPPORTS Cross line length Minimum Rib Length (a) The minimum rib length determines th cross line. Larger ribs are more stable harder to remove Maximum Contact Length (b) Maximum contact length limits the ler between the support and the surfact	e but may be 0.5 mm ngth of the contact	
Save changes in:	Machine library		OK Cancel Apply Help

Figure 4.26. Introducing machine settings – cross line length



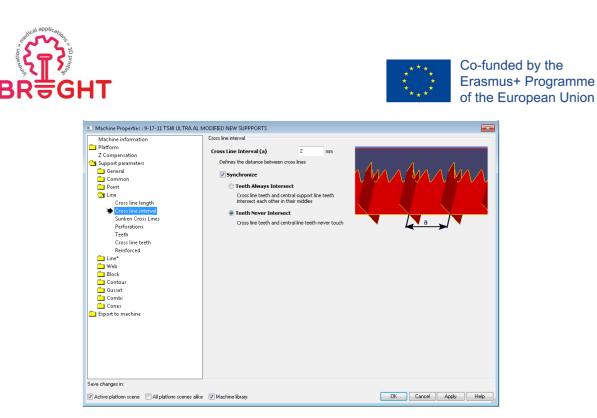


Figure 4.27. Introducing machine settings – Cross line interval

In Figure 4.27 is defined cross line interval. In Figure 4.28 is defined sink cross lines with distance.

Machine information Machine information Surker Closs Lines Define datance between the cross line and the surface					
Block     Contour     Gusset     Combi     Consi     Export to machine	Machine information Platform Compensation Compensation Compensation Coss line length Cross line length Cross line interval Cross line interval Cross line interval Cross line teth Cross line teth Cross line teth Reinforced Line* Uteb Block Contour Gusset Contour Gusset Contour Susset Sport to machine	Sunken Cross Lines Sink Cross Lines Sunken cross lines provide support on they do not buch the part. By sinking lose contact with the supporting surfat to the line support Distance 2.3	p the cross lines, they will see and only give support 5 mm		
Save changes in:		V Machine library		OK Cancel	Apply Help

Figure 4.28. Introducing machine settings – sunken cross lines







🖸 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPOR	TS		×
Machine information	Perforations			
Platform	Perforations		Diamond -	*********
Z Compensation				
Support parameters	Beam (a)	1.5	mm	d
General	Angle (b)	60	۰	
Common	Height (c)	0.8	mm	
	Solid Height (d)			ь 🔨 🗛
Cross line length	Solia Height (a)	1	mm	
Cross line interval				
Sunken Cross Lines				
Perforations				
Teeth				
Cross line teeth				d
Reinforced				<b>4</b>
🗀 Line*				
🗀 Web 🗀 Block				
Contour				
Gusset				
Combi				
Cones				
🗀 Export to machine				
Save changes in:				
Active platform scene 📃 All platform scenes alike	Machine library			OK Cancel Apply Help

Figure 4.29. Introducing machine settings – perforations

In Figure 4.29 is defined dimensions for perforations. In Figure 4.30 is defined dimensionsfor teeth.

Machine Properties : 9-17-11 TS48 ULTRA AL N		ç				×
Machine information	Teeth	3				~
Platform						
Z Compensation			r 🔽 Lowe	er	, b	
Can Support parameters	Height (a)	4	4	mm		
🗀 General	Top Length (b)	0.3	0.3	mm		
🗀 Common	Base Length (c)	0.8	0.8	mm		
Doint Doint	2					
🔁 Line	Base Interval (d)	0.8	0.8	mm		
Cross line length Cross line interval	Lower Teeth Same as	Upper Tee	th		C C	∖ d
Sunken Cross Lines	🔽 Full Teeth in Ends					
Perforations → Tection Cross line teeth Reinforced ↓ Line* → Webs → Block → Contour → Gusset → Combi → Combi → Cones → Export to machine	Lower teeth are crea	ted if supp	ort leans o	n an upfaing teeth are created		
Save changes in:						
-	_					
Active platform scene All platform scenes alike	Machine library				OK Cancel Apply	Help

Figure 4.30. Introducing machine settings – line teeth







📧 Machine Properties : 9-17-11 TS48 ULTRA AL M	IODIFIED NEW SUPPPORT	s				×
Machine information	Cross line teeth					
Platform		<b>V</b> Upper	I owe			
Z Compensation					/b	
Ca Support parameters	Height (a)	5	5	mm		
🗀 General	Top Length (b)	0.35	0.35	mm		
Common District	Base Length (c)	0.8	0.8	mm		
	Base Interval (d)	0.8	0.8	mm		
Cross line length						
Cross line interval	Lower Teeth Same as	Upper Teeth	1		C N	Nd ∣
Sunken Cross Lines						
Perforations						
Teeth	Lower teeth are crea surface. If support le	eans on a pla	t leans or tform, no	teeth are created		
Cross line teeth Reinforced						
Keinforced						
Web						
Block						
🗀 Contour						
🗀 Gusset						
🗀 Combi						
Cones						
Export to machine						
Save changes in:						
Active platform scene 🔲 All platform scenes alike	Machine library				OK Cancel	Apply Help

Figure 4.31. Introducing machine settings – cross line teeth

In Figure 4.31 is defined dimensions for cross line teeth. In Figure 4.32 is defined reinforced for line support.

Machine Properties : 9-17-11 TS48 ULTRA AL N Machine information Platform Z Compensation General Consonn Point Cross line length Cross line interval Sunken Cross Lines Perforations Teeth Cross line teeth Fisionforceo Line* Web Block Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Gusset Combour Combour Cons Directories Combour Cons Combour Combour Combour Combour Combour Cons Combour Cons	ODIFIED NEW SUPPPORTS Reinforced Places a box around a line support f Reinforcement Height Line and Line "supports below t reinforced automaticaly Note: Reinforcement Height is Support Parameter Pages	30 mm his height will not be		
Save changes in:	The Advention Disease		OK. Cance	Apply Help
Active platform scene C All platform scenes alike	Machine library		UK Cance	si Apply Help

Figure 4.32. Introducing machine settings – reinforced



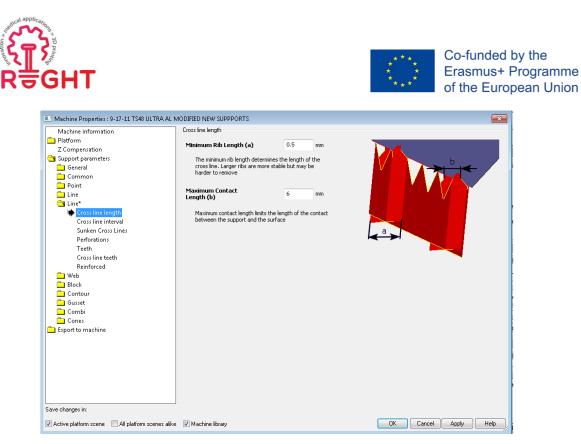


Figure 4.33. Introducing machine settings – cross line length

In Figure 33 is defined cross line length for support. In Figure 4.34 is defined cross line interval for line support structure.

Machine Properties : 9-17-11 TS48 ULTRA AL M Machine information Platform Z Compensation Support parameters G General C Common Point ine	IODIFIED NEW SUPPPORTS Cross line interval Cross Line Interval Defines the distance between cross Synchronize Teeth Always Intersect Cross line teeth and central intersect each other in their	support line	mm			
<ul> <li>Line*</li> <li>Cross line length</li> <li>✓ cross line interval</li> <li>Sunken Cross Lines</li> <li>Perforations</li> <li>Teeth</li> <li>Cross line teeth</li> <li>Reinforced</li> <li>Web</li> <li>Block</li> <li>Contour</li> <li>Gusset</li> <li>Combi</li> <li>Cones</li> <li>Export to machine</li> <li>Save chances in:</li> </ul>	Teeth Never Intersect Cross line teeth and central	line teeth n	ever touch			
Active platform scene All platform scenes alike	V Machine library			OK	Cancel Apply	Help

Figure 4.34. Introducing machine settings – cross line interval







💷 Machine Properties : 9-17-11 TS48 ULTRA AL M	IODIFIED NEW SUPPPORTS		
Machine information	Sunken Cross Lines		
Platform	Sink Cross Lines		
Z Compensation	Sunken cross lines provide suppo	rt only to the central line;	
Support parameters General	they do not touch the part	,	
Common			
Point			
🛅 Line	Distance	2 mm	
😋 Line*			
Cross line length	Define distance between the	cross line and the surface	
Cross line interval			
Sunken Cross Lines Perforations			
Teeth			
Cross line teeth			
Reinforced			
🗀 Web			
Block			
🗖 Contour			
Combi			
Cones			
Export to machine			
Save changes in:			
Active platform scene 🔲 All platform scenes alike	Machine library		OK Cancel Apply Help

Figure 4.35. Introducing machine settings – sunken cross lines

In Figure 4.35 is defined sunken cross lines. In Figure 4.36 is defined dimensions forperforations.

Machine Properties : 9-17-11 TS48 ULTRA AL M Machine information Platform Z Compensation Support parameters General Cost in a context of the second	ODIFIED NEW SUPPPO Perforations Beam (a) Angle (b) Height (c) Solid Height (d)	1.2 60 1.2 2	Diamond  mm o mm mm				
	V Machine libraru			OK	Cancel	Apply	Help .
							<i>\</i> //

Figure 4.36. Introducing machine settings – perforations







Page | 24

🛄 Machine Properties : 9-17-11 TS48 ULTRA AL M	ODIFIED NEW SUPPPORTS						<b>**</b>
Machine information	Teeth						
💼 Platform		🔽 Upper	Lower		1		
Z Compensation	Height (a)	2	2	mm		<b>/</b> <sup>b</sup>	
Support parameters						K	
Common	Top Length (b)	0.3	0.3	mm			
Point	Base Length (c)	0.8	0.8	mm			
Line	Base Interval (d)	0.8	0.8	mm			
🔁 Line*							
Cross line length	V Lower Teeth Same as L	pper leeth			-	<b>└─</b> ►	۲ <b>۵</b>
Cross line interval	📝 Full Teeth in Ends						
Sunken Cross Lines	Lower teeth are create	ed if sunnor	t leans on	an unfacion			
Perforations	Lower teeth are create surface. If support lea	ns on a plat	form, no	teeth are created			
Cross line teeth							
Reinforced							
🗀 Web							
🗖 Block							
🧰 Contour							
🗀 Gusset							
Combi							
Cones							
Export to machine							
Save changes in:							
Active platform scene 📃 All platform scenes alike	Machine library				OK (	Cancel Apply	ly Help

Figure 4.37. Introducing machine settings – teeth

In Figure 4.37 is defined dimensions for teeth. In Figure 4.38 is defined dimensions forcross line teeth.

Machine Properties : 9-17-11 TS48 ULTRA AL N	10DIFIED NEW SUPPPORTS	S				×
Machine information	Cross line teeth					
🗀 Platform		📝 Upper				
Z Compensation				r	_b	
C Support parameters	Height (a)	1.5	1.5	mm		
🗀 General	Top Length (b)	0.3	0.3	mm		
Common		0.8	0.8			
C Point	Base Length (c)	0.8	0.8	mm		
🗀 Line	Base Interval (d)	0.8	0.8	mm		
🔁 Line*	V Lower Teeth Same as	Janes Task				
Cross line length	Cower reeurbaille as	upper reeu			→	•a
Cross line interval						
Sunken Cross Lines		1.16				
Perforations	Lower teeth are creat surface. If support lea	eo ir suppo ans on a nia	rt ieans oi itform, no	n an upracing		
Teeth						
Cross line teeth						
Reinforced						
🗀 Web						
Block						
Contour Contour						
Gusset						
Combi						
Cones						
Export to machine						
Save changes in:						
Active platform scene 🔲 All platform scenes alike	Machine library				OK Cancel Apply	Help

Figure 4.38. Introducing machine settings – cross line teeth







📧 Machine Properties : 9-17-11 TS48 ULTRA AL N	ODIFIED NEW SUPPPOR	rs						<b>×</b>
Machine information	Hatching							
🗀 Platform	Set the parameters for t	he hatch	ing strategy	of block	sunnorts denendir	n on Surface are	ta.	
Z Compensation						-		
🔁 Support parameters			Dimension		X Hatching (a)	Y Hatching (b	)	
🗀 General	Delta X or Delta Y	< 🗸	5	mm	1.5	1.5	mm	
Common			6	1	1.5	1.5		
🗀 Point 🗀 Line	Delta X or Delta Y	> -		mm			mm	
Line	Delta X or Delta Y	>	8	mm	2.8	2.8	mm	$\wedge$
Web	Surface <	-	0	mm^2	6	6	mm	$  \rangle \rangle$
G Block		01	r: default		2.8	6	mm	
Hatching		Outer	r; uerauit		2.0	Ľ		
Teeth on hatching								
Teeth synchro	Rotation Angle (c)	10	°					
Fragmentation								
Hatch removal								
Borders								
Teeth on border							То	create only a border and remc
Perforations Unperforated borders							ha	tching size (100mm)
Gusset Border								
Contour								
Gusset								
Combi								
Cones								
Export to machine								
Save changes in:								
Active platform scene 🔲 All platform scenes alike	🔽 Machine library					OK	Canc	el Apply Help

Figure 4.39. Introducing machine settings – hatching

In Figure 4.39 is defined dimensions for hatching as blocks of support structure. InFigure 4.40 is defined dimensions for teeth on hatching.

Machine Properties : 9-17-11 TS48 ULTRA AL N	10DIFIED NEW SUPPPORTS				×
Machine information	Teeth on hatching				
🗀 Platform		🔽 Linner	V Lowe	r	
Z Compensation		5	5		∕ <sup>b</sup>
Support parameters	Height (a)	-		mm	K
General	Top Length (b)	0.15	0.15	mm	
💼 Common	Base Length (c)	0.5	0.5	mm	
	Base Interval (d)	1	1	mm	
Line*					
🗖 Web	🔽 Lower Teeth Same as l	Jpper Teet	h		∠ C ∖d
C Block					
Hatching					
🖤 Teeth on hatching	Lower teeth are create surface. If support lea	ed it suppo Ins on a pla	rt leans or atform, no	n an uphacing teeth are created	
Teeth synchro					
Fragmentation					
Hatch removal Borders					
Borders Teeth on border					
Perforations					
Unperforated borders					
Gusset Border					
Contour					
Gusset					
🗀 Combi					
Cones					
💼 Export to machine					
Save changes in:					
Active platform scene All platform scenes alike	📝 Machine library				OK Cancel Apply Help

Figure 4.40. Introducing machine settings – teeth on hatching



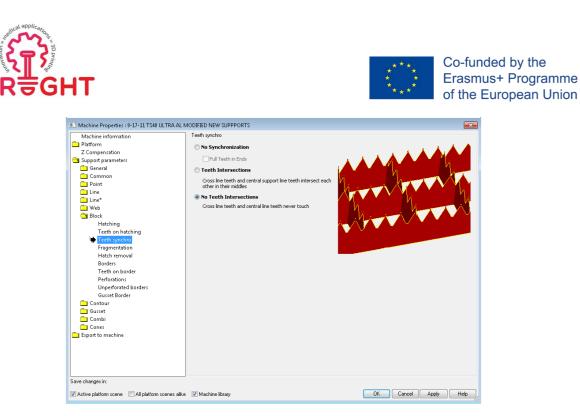


Figure 4.41. Introducing machine settings – teeth synchro

In Figure 4.41 is defined teeth synchro. In Figure 4.42 is defined dimensions for fragmentation.

II Machine Properties : 9-17-11 TS48 ULTRA AL M	IODIFIED NEW SUPPPORTS				<b>—</b> ×
Machine information	Fragmentation				
🗀 Platform					
Z Compensation Support parameters General	To facilitate the removal of the support, select fragmentation to create gaps in the support				
Common	X Interval (a)	20	mm		
🗀 Point	Y Interval (b)	10	mm		
Line	Separation Width (c)	0.5	mm		
Web Web Block Hatching Teth on hatching Teth on hatching Teth on border Hatch removal Borders Teth on border Perforations Unperforated borders Guisset Border Contour Guisset Border Combi Cones Export to machine	Pragmentate Borders				
Save changes in:					
Active platform scene All platform scenes alike	Machine library			OK Cancel Apply H	lelp

Figure 4.42. Introducing machine settings – fragmentation



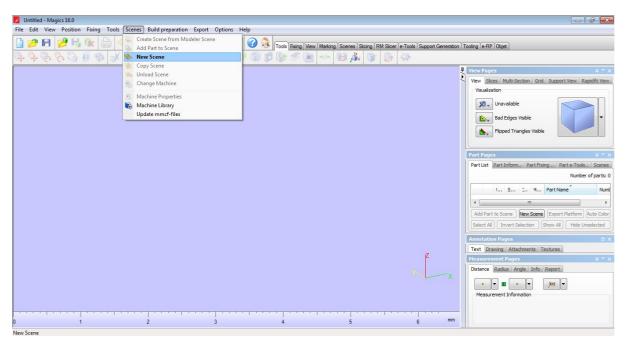




💽 Machine Properties : 9-17-11 TS48 ULTRA AL N	10DIFIED NEW SUPPPOR	RTS		
Machine information	Perforations			
Platform				*********
Z Compensation	Perforations		Diamond -	
🔁 Support parameters	Beam (a)	0.8	mm	d
🚞 General	Angle (b)	60	•	
🗀 Common			_	
🗀 Point	Height (c)	0.8	mm	b 🔭 a
🗀 Line	Solid Height (d)	0.8	mm	
🗀 Line*				
🗀 Web				
C Block				
Hatching				
Teeth on hatching				
Teeth synchro				d
Fragmentation Hatch removal				+
Hatch removal Borders				
Teeth on border				
Perforations				
Unperforated borders				
Gusset Border				
Contour				
Gusset				
Combi				
Cones				
Export to machine				
Save changes in:				
Active platform scene All platform scenes alike	📝 Machine library			OK Cancel Apply Help

Figure 4.43. Introducing machine settings – block perforations

In Figure 4.43 is defined dimensions for block perforations. In Figure 4.44 is introducingnew scene in the software by using card Scenes.



#### Figure 4.44. New scene







Change Machine		Change Machine	<b>—</b>
Select Machine Material Comment	Envisiontec Ultra 3SP (mm) (No Machine) Envisiontec Perfactory (mm) Envisiontec Ultra 3SP (mm)	Select Machine Material Comment	Envisiontec Ultra 3SP (mm)  Photopolymer none
	Ok Cancel Help		Ok Cancel Help

Figure 4.45. Introducing machine settings at new scene

In Figure 4.45 are chosen defined "Envisiontec Ultra 3SP" machine. After the definition of machine setting is finished and this needs to be done only once, is possible to continue work with part. Therefor in Figures 4.46 - 4.48 is shown the position and support structure by selection "block" support parameter.

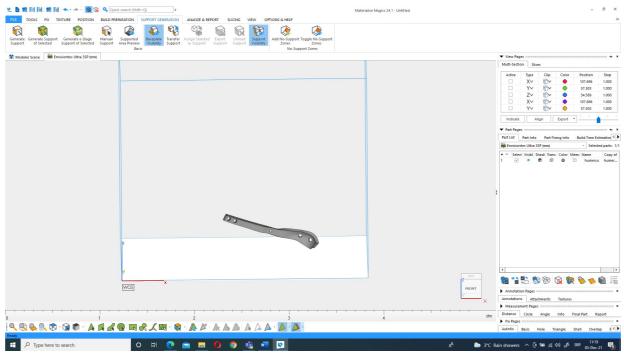


Figure 4.46. Importing part into Material Magics







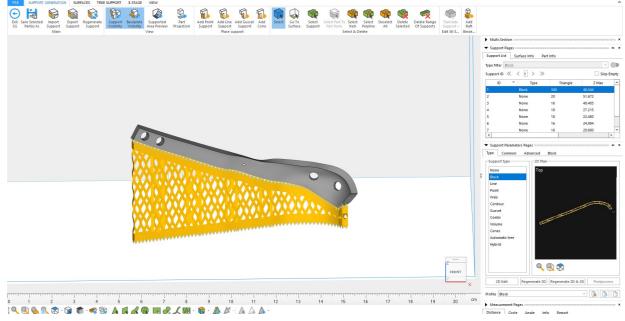
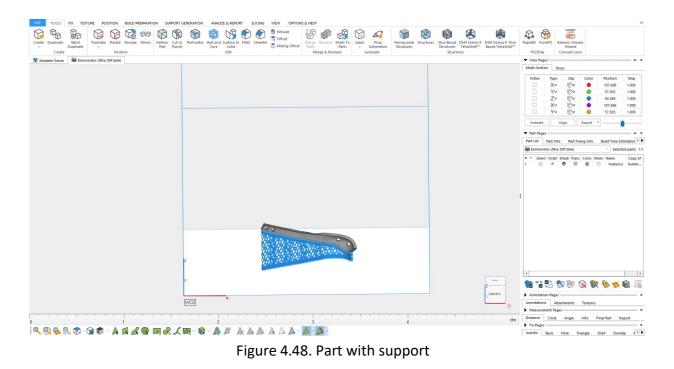


Figure 4.47. Defining support structure

In Figure 4.47 is shown part with, in previous steps, defined support structure. For this support structure is used block support. In Figure 4.48 is shown position of the part with support structure on the platform.









#### 5. Printing of part

The printing process for this part was around 7 hours long. Influence on printing speed is very small comparing to the FDM printing process. Printing process is defined by speed of laser per layer in which there is small difference between big and small image. The most important way to influence the printing speed is the have position of the part has less layers.

Figure 5.49. shows the laser that is on the top over the tank with resin material. Laser ismoving left and right and every time makes solidification of one layer. During the printing process, printed part cannot be seen since it is immersed in the tank full of resign. The whole size of printed part is limited with the size of the tank in this architecture of stereolithography printers.



Figure 5.49 Printing of part in the 3D printer

In Figure 5.50 is shows how printed part appears after the printing is finished.

For the postprocessing is important to know that not solidification resign is hazardous and all the operation need to be done so that human skin do not have contact with resign. At Figure 5.51. is shown separation of part with support structure from theplatform and in this process is important to use skin protecting gloves. After the part is separated from the platform is very important to clean part as well as platform since for the next printing is important not to contaminate resign in the tank where platform is going tobe immersed.







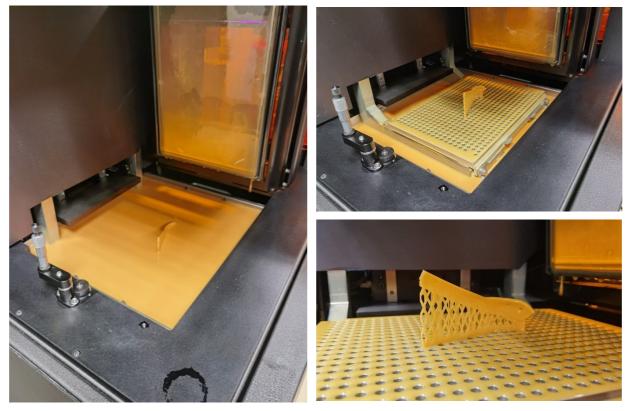


Figure 5.50 Finishing of printing of the part

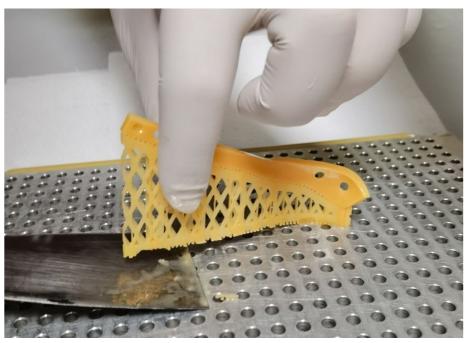


Figure 5.51. Separation of printed part from platform

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Page | 31





In Figure 5.51 is shown removing of part with support structure from platform by using a spatula. After the part is removed it is necessary to wash it with isopropyl alcohol and it is advised it to put it in some bowl filled with isopropyl alcohol and to wash it and clean with brush.



Figure 5.52. Washing of part in isopropyl alcohol







#### 6. Postprocessing

In the Figure 6.53 is shown process of separating support structure from part. If the machine settings are good introduced as it is shown in part 4 this is not going to be problem and there is no dangerous to damage printing part.

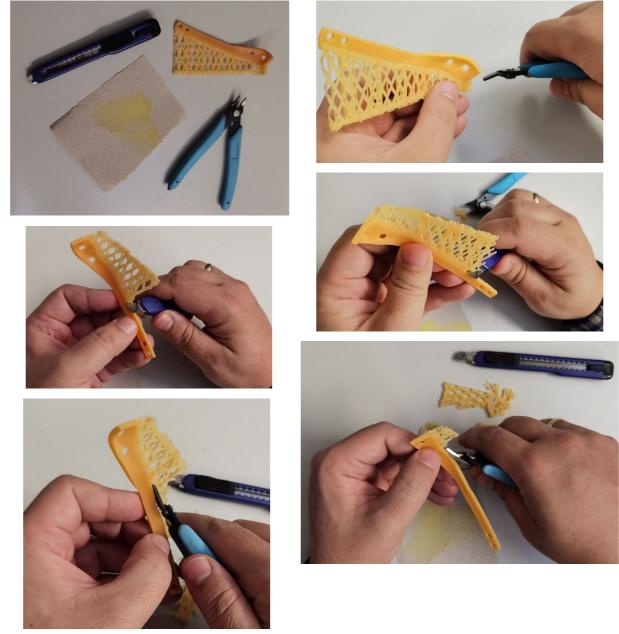


Figure 6.53. Postprocessing of 3D printed part









Figure 6.54. Postprocessing of 3D printed part

After separating part from support need to be used sandpaper to make smooth surface where it was connected to the support structure (Figure 6.54).





Figure 6.55. Printed part

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Page | 34





In the Figures 6.55 is shown finished and postprocessed printed part. In Figure .56 is given SLA and FDM printed parts for comparison. Surfaces of SLA printed parts are much finer.



Figure 6.56. Printed part by FDM (up) and Stereolithography (down)

#### 7. Conclusions

In this toolkit is presented printing process with all necessary pre- and postprocessing step as well as machine settings for successful printing of the part – Locking Compression Plates which is used in surgery.

The printing process was done with Envisiontec Ultra 3SP. For the slicer is used Materialise Magics. In this software need to be imported STL file that can be done in almost any CAD software. For Materialise Magics was shown the whole process of machine setting that is important for fine printing and especially for the creating good support structure. In Materialise Magics is done slicing of the part and choosing the support structure as well as positioning the part on the platform.

After the printing process is finished is important to have smooth separation of part from the printing platform as well as support structure from the printed part.

