

VAN BIM-MODEL NAAR PRINT-MODEL EN BOUW-TECHNISCHE DETAILS



OVERZICHT PRESENTATIE

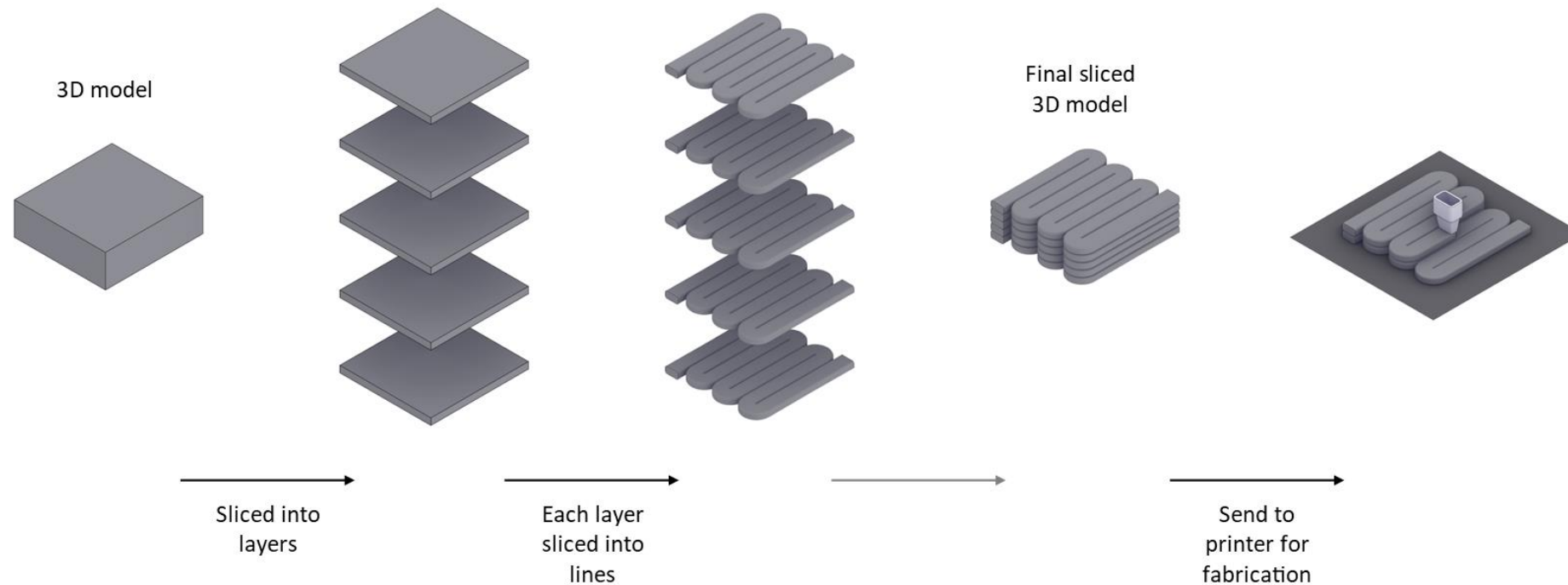
INHOUDSTAFEL

- **Print Software – Axel Boons**
 - **Slicer-Software voor 3D-Betonprinten**
 - **Parametrisch Design**
- BIM-model naar PRINT-model – Wouter Bourgeois
- Bouw-technische details – Antonie Damad

SLICER-SOFTWARE VOOR 3D-BETONPRINTING

Slicer-software workflow

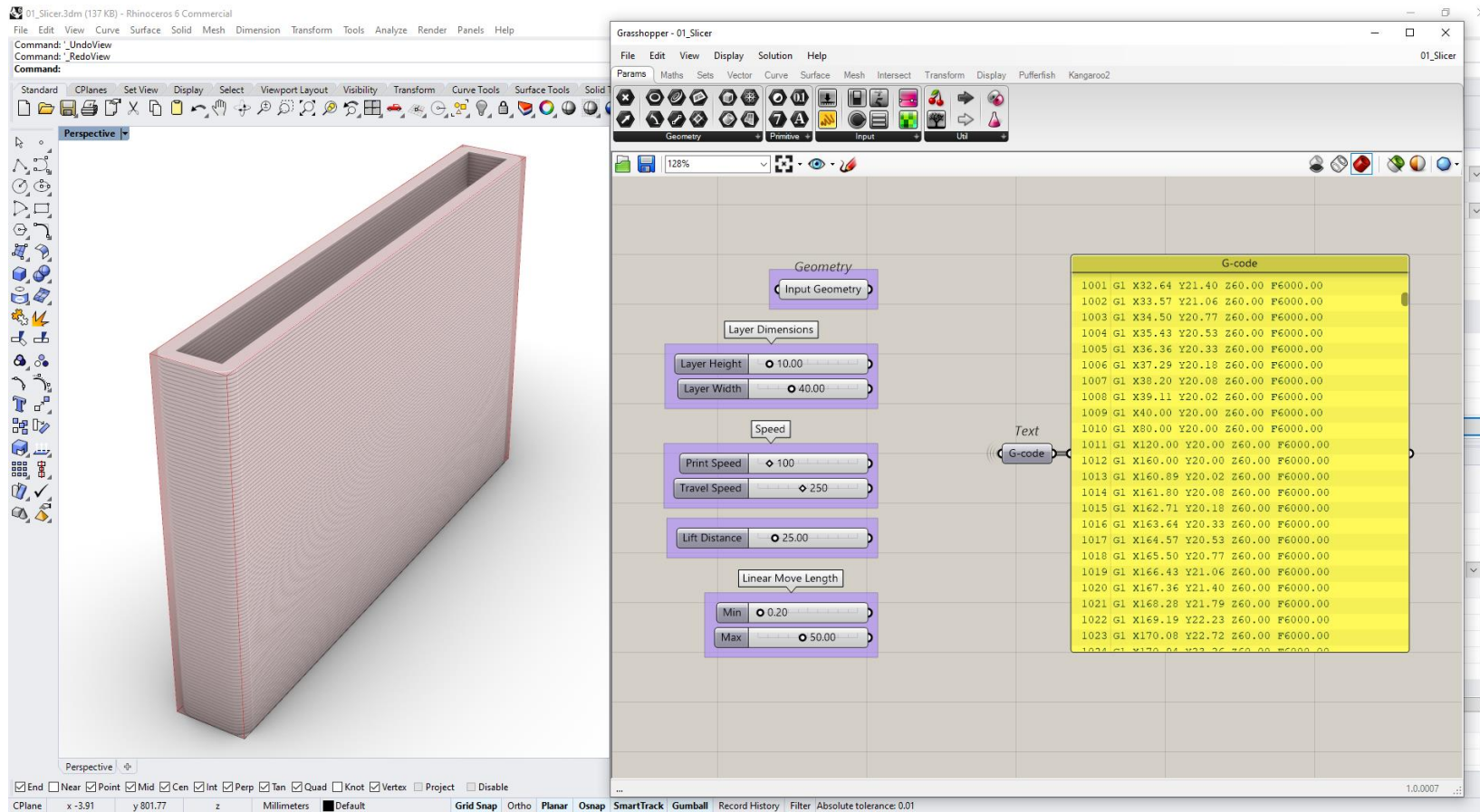
- Waarom slicer-software nodig
- Wat doet een slicer-software

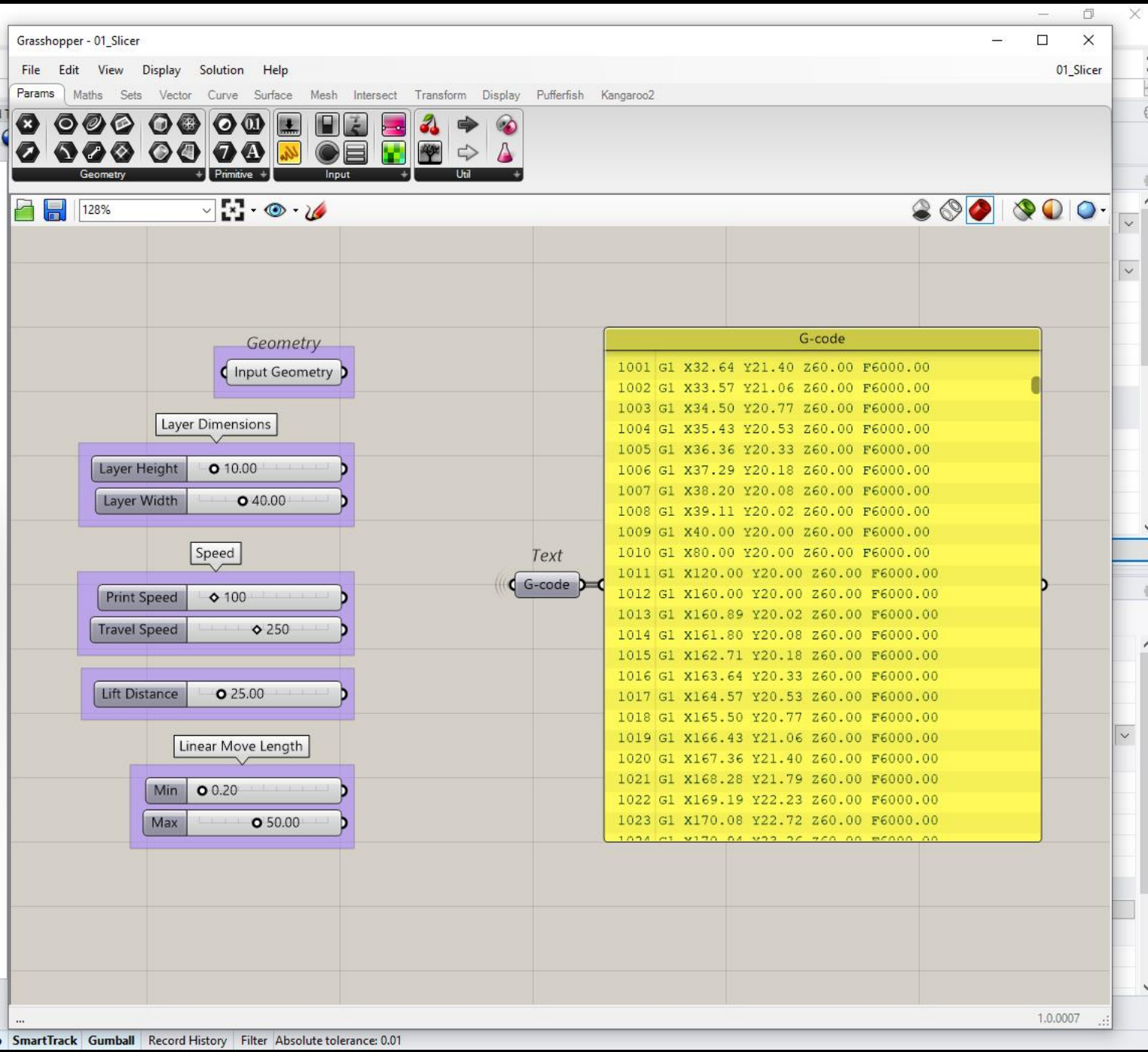
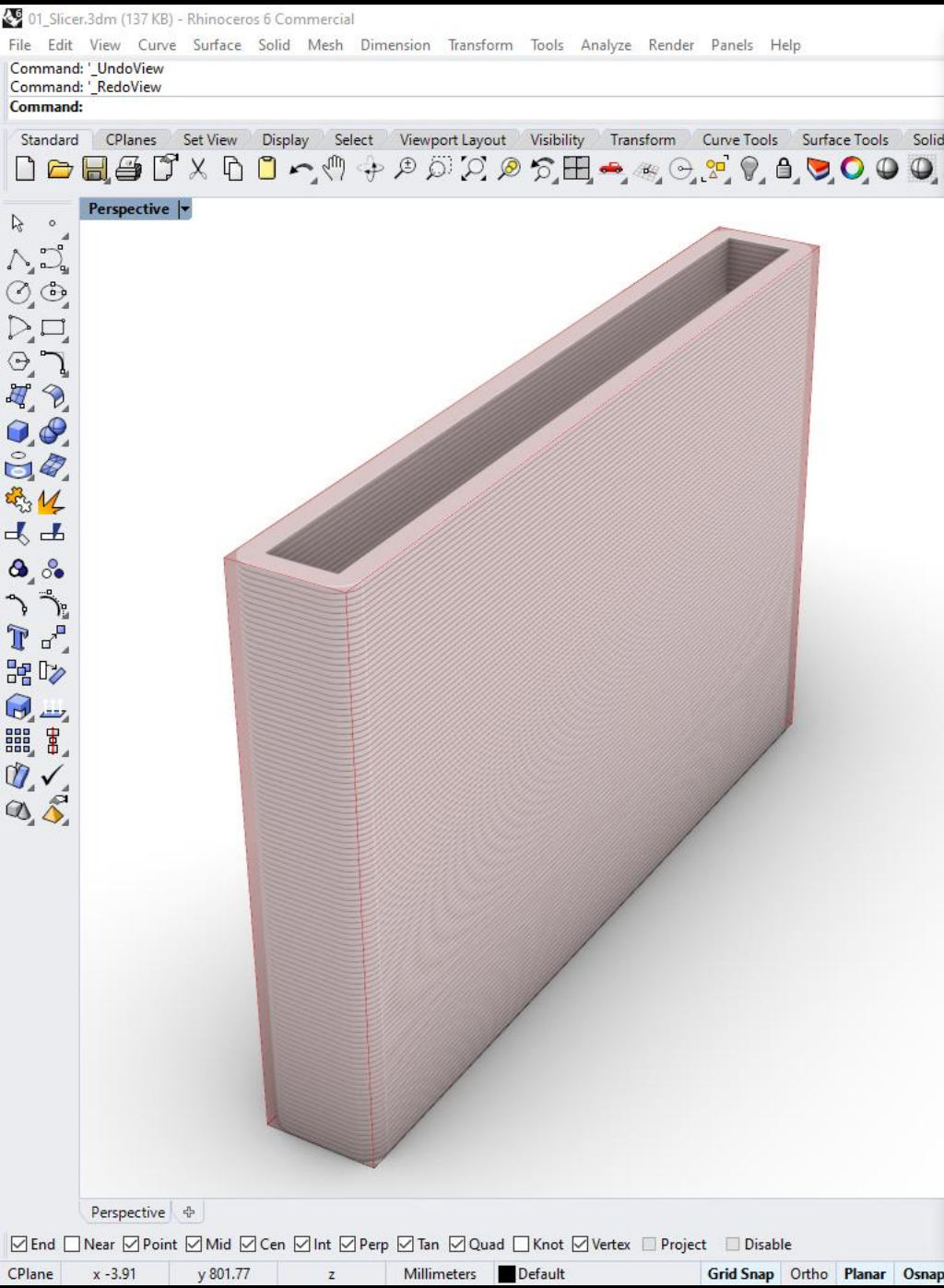


SLICER-SOFTWARE VOOR 3D-BETONPRINTING

Beste software voor 3D-betonprinting

- Rhino Grasshopper

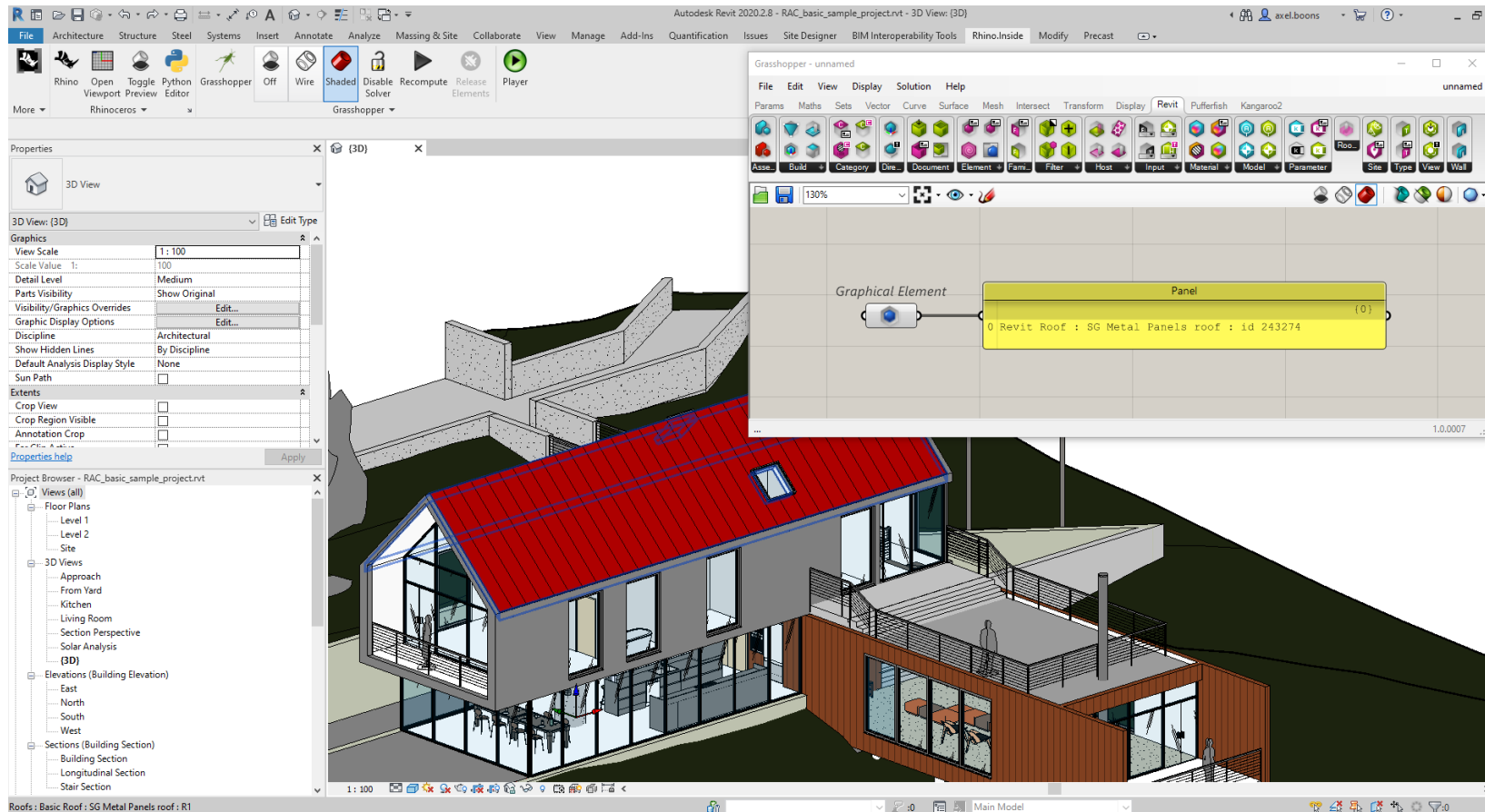




SLICER-SOFTWARE VOOR 3D-BETONPRINTING

Koppeling met BIM-software

- Link Revit / Rhino Grasshopper – (Rhino.Inside)



Properties

3D View

3D View: {3D} Edit Type

Graphics

View Scale	1:100
Scale Value 1:	100
Detail Level	Medium
Parts Visibility	Show Original
Visibility/Graphics Overrides	Edit...
Graphic Display Options	Edit...
Discipline	Architectural
Show Hidden Lines	By Discipline
Default Analysis Display Style	None
Sun Path	<input type="checkbox"/>

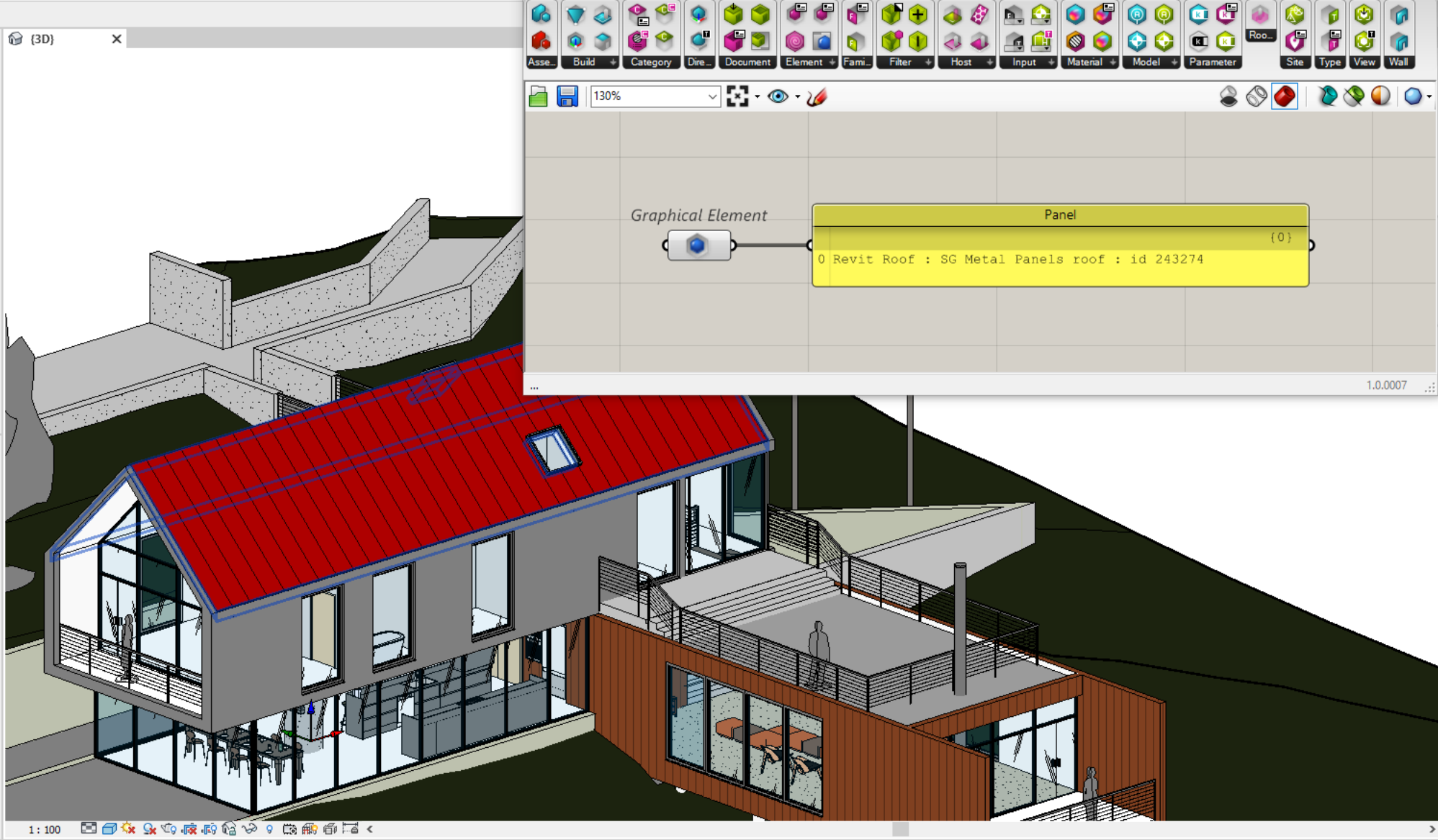
Extents

Crop View	<input type="checkbox"/>
Crop Region Visible	<input type="checkbox"/>
Annotation Crop	<input type="checkbox"/>

Apply

Project Browser - RAC_basic_sample_project.rvt

- Views (all)
 - Floor Plans
 - Level 1
 - Level 2
 - Site
 - 3D Views
 - Approach
 - From Yard
 - Kitchen
 - Living Room
 - Section Perspective
 - Solar Analysis
 - (3D)
 - Elevations (Building Elevation)
 - East
 - North
 - South
 - West
 - Sections (Building Section)
 - Building Section
 - Longitudinal Section
 - Stair Section



Grasshopper - unnamed

File Edit View Display Solution Help

Params Maths Sets Vector Curve Surface Mesh Intersect Transform Display Revit Pufferfish Kangaroo2

Asse... Build + Category Dire Document Element + Fami Filter + Host + Input + Material + Model + Parameter Site Type View Wall

130%

Graphical Element

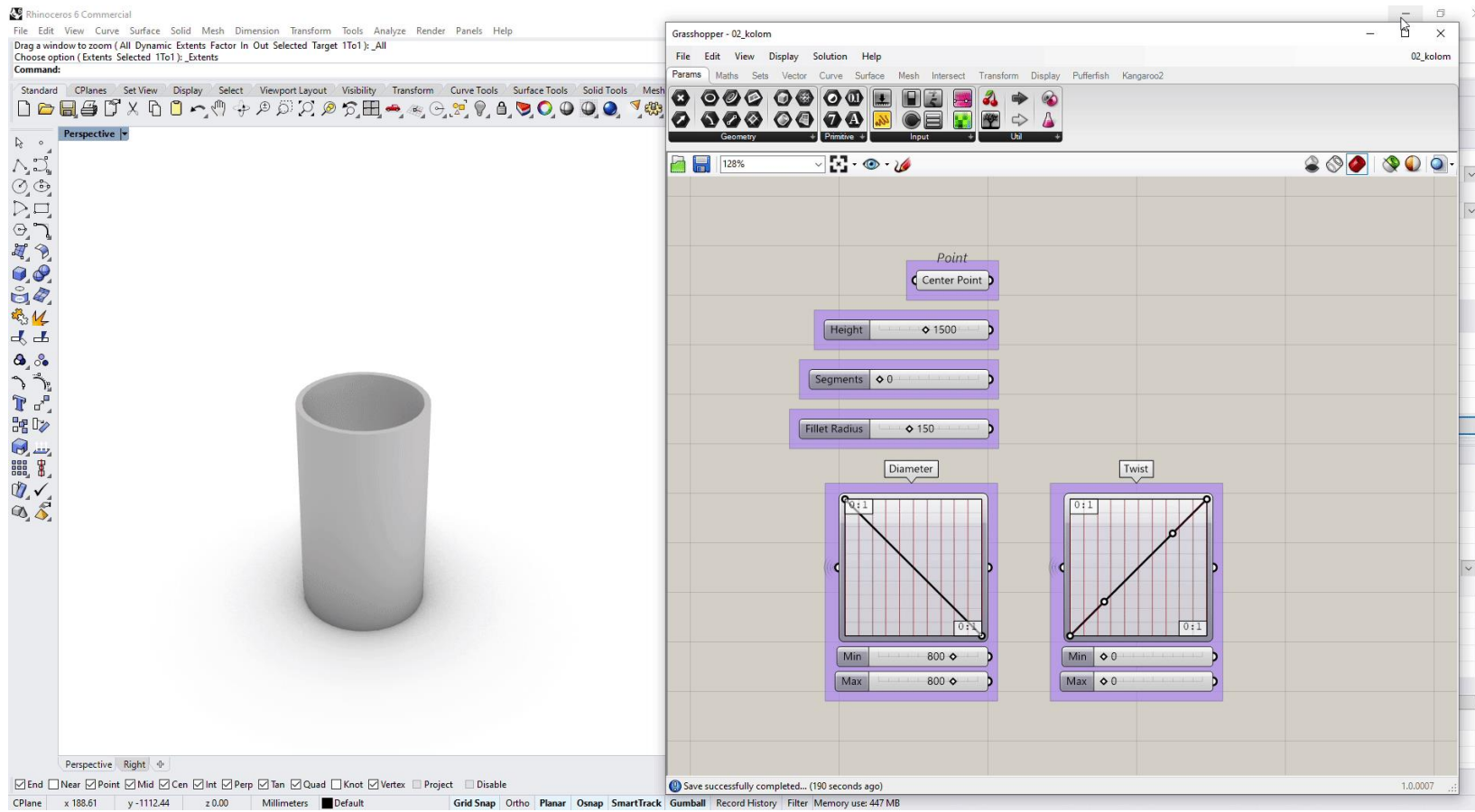
Panel

```
0 Revit Roof : SG Metal Panels roof : id 243274
```

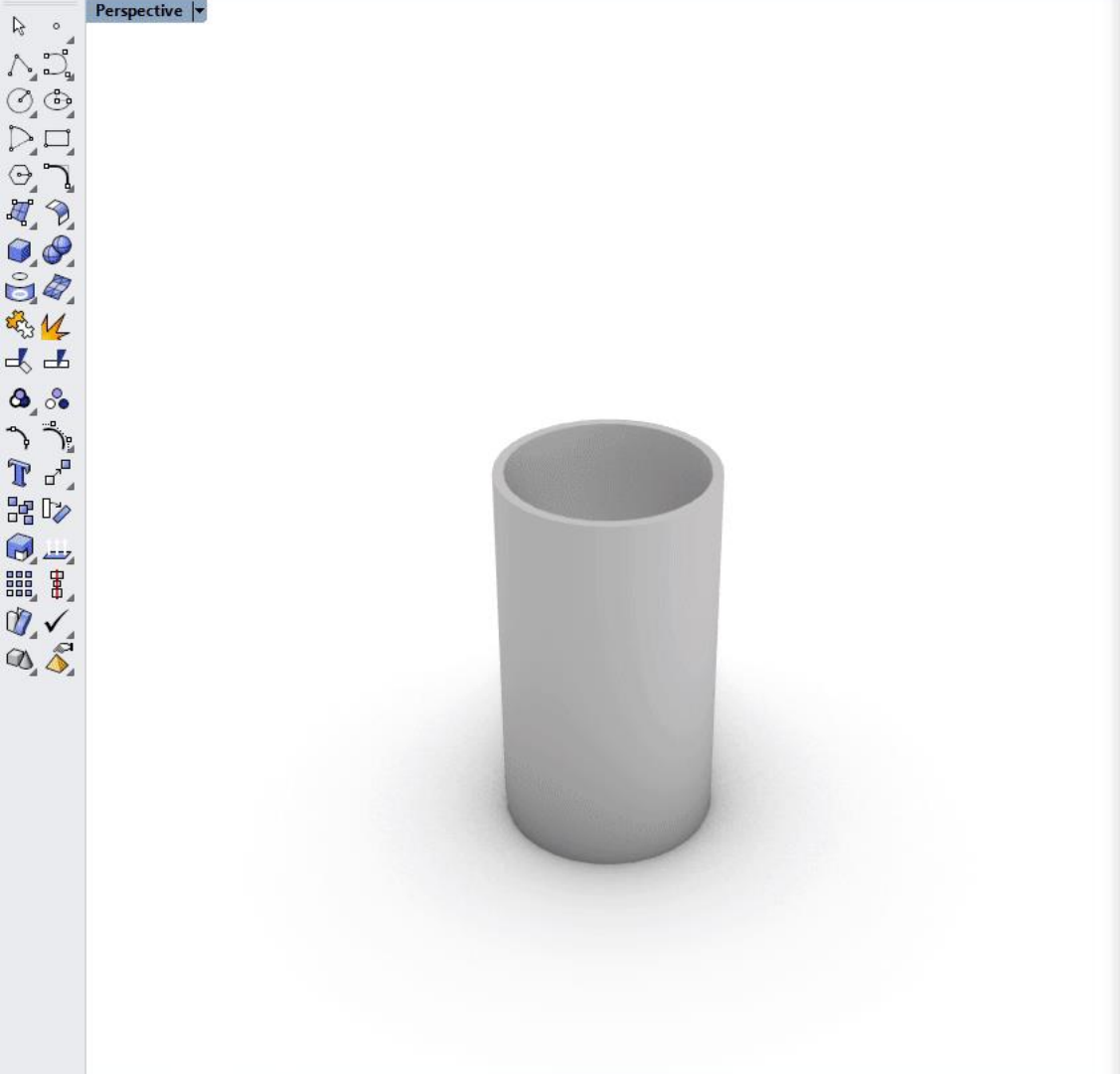
1.0.007

PARAMETRISCH DESIGN

Wat is parametrisch design?



Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh



Geometry Primitive Input Util

128%

Point

Center Point

Height 1500

Segments 0

Fillet Radius 150

Diameter

Twist

0:1 0:1

Min 800 Max 800

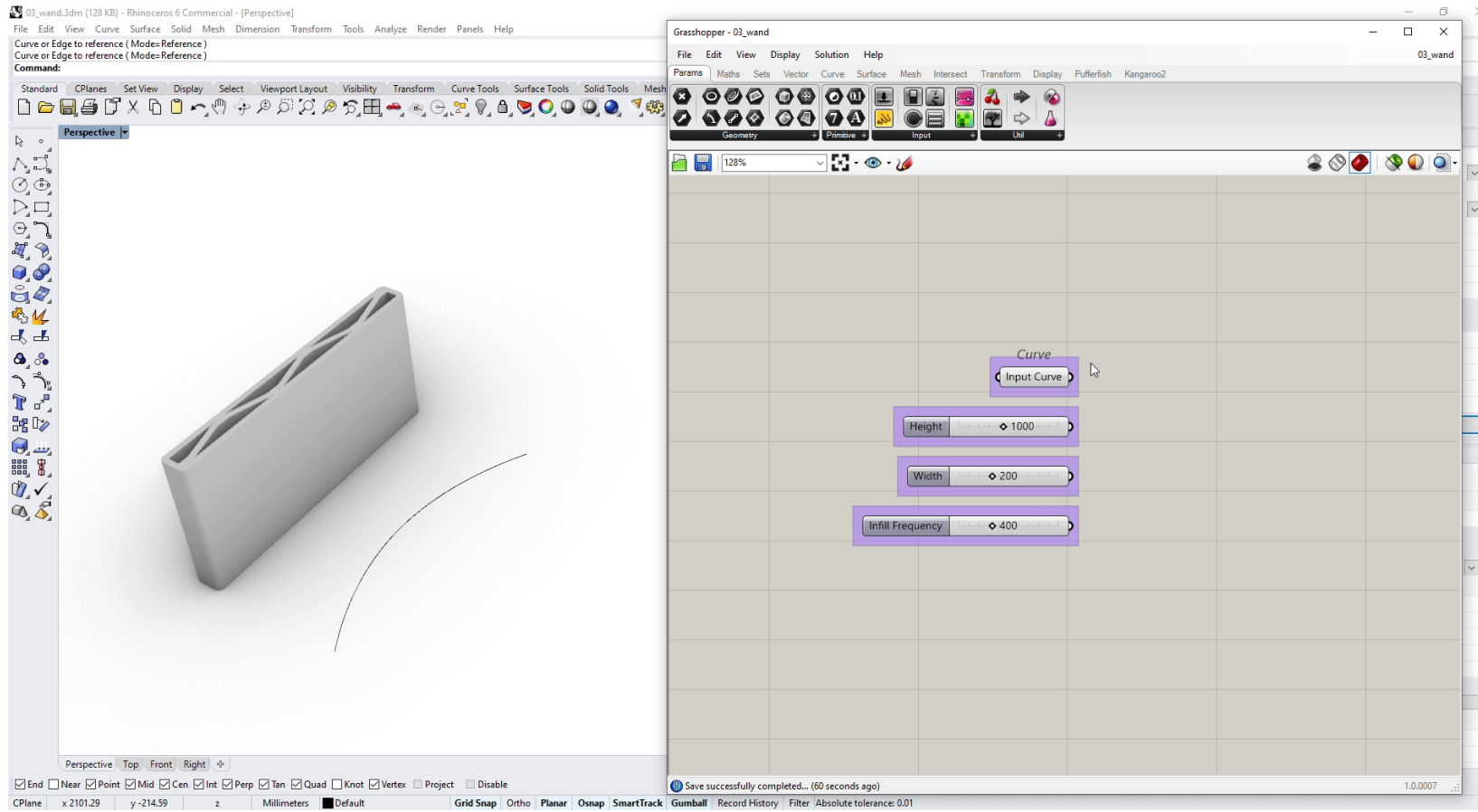
Min 0 Max 0

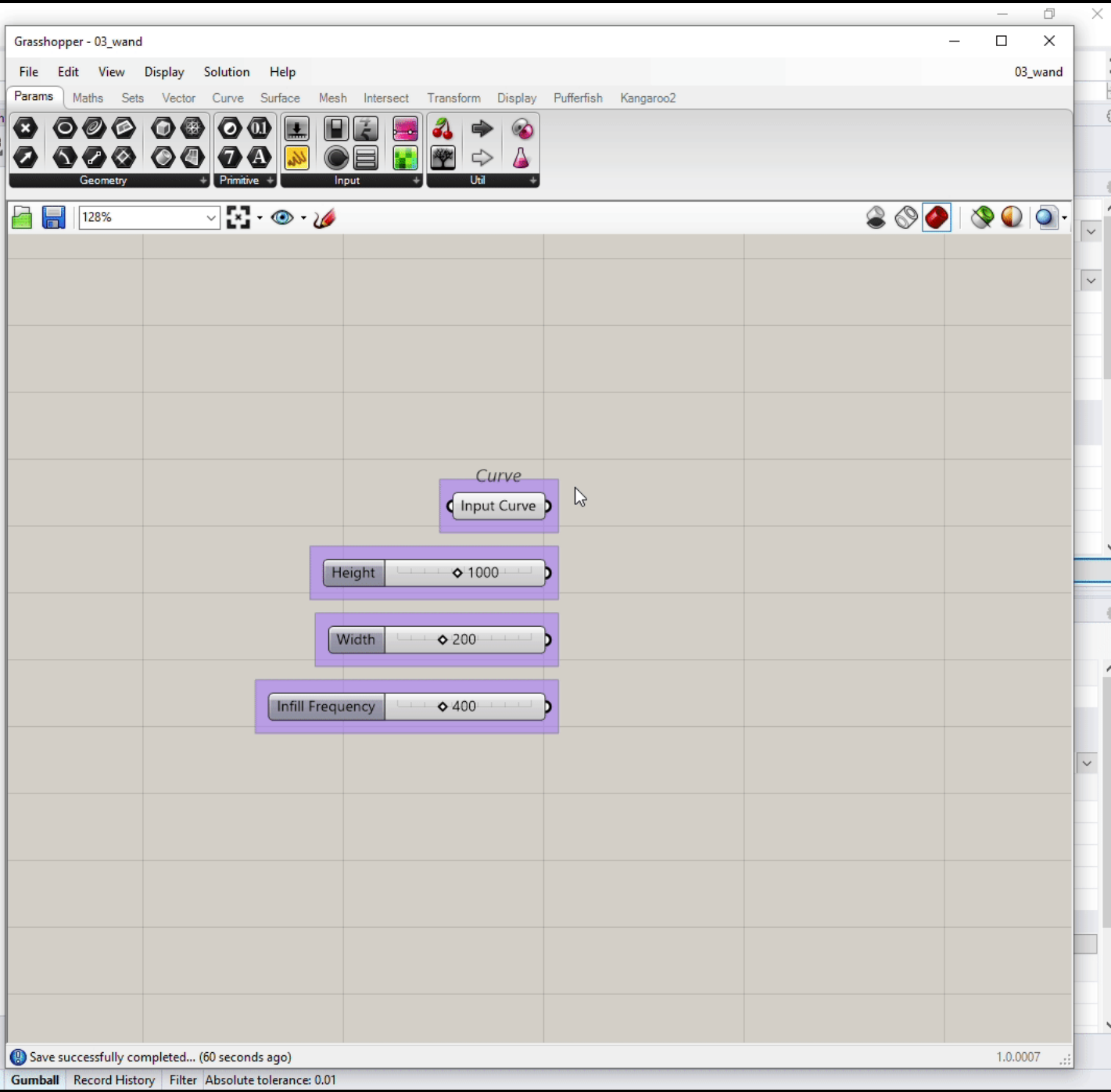
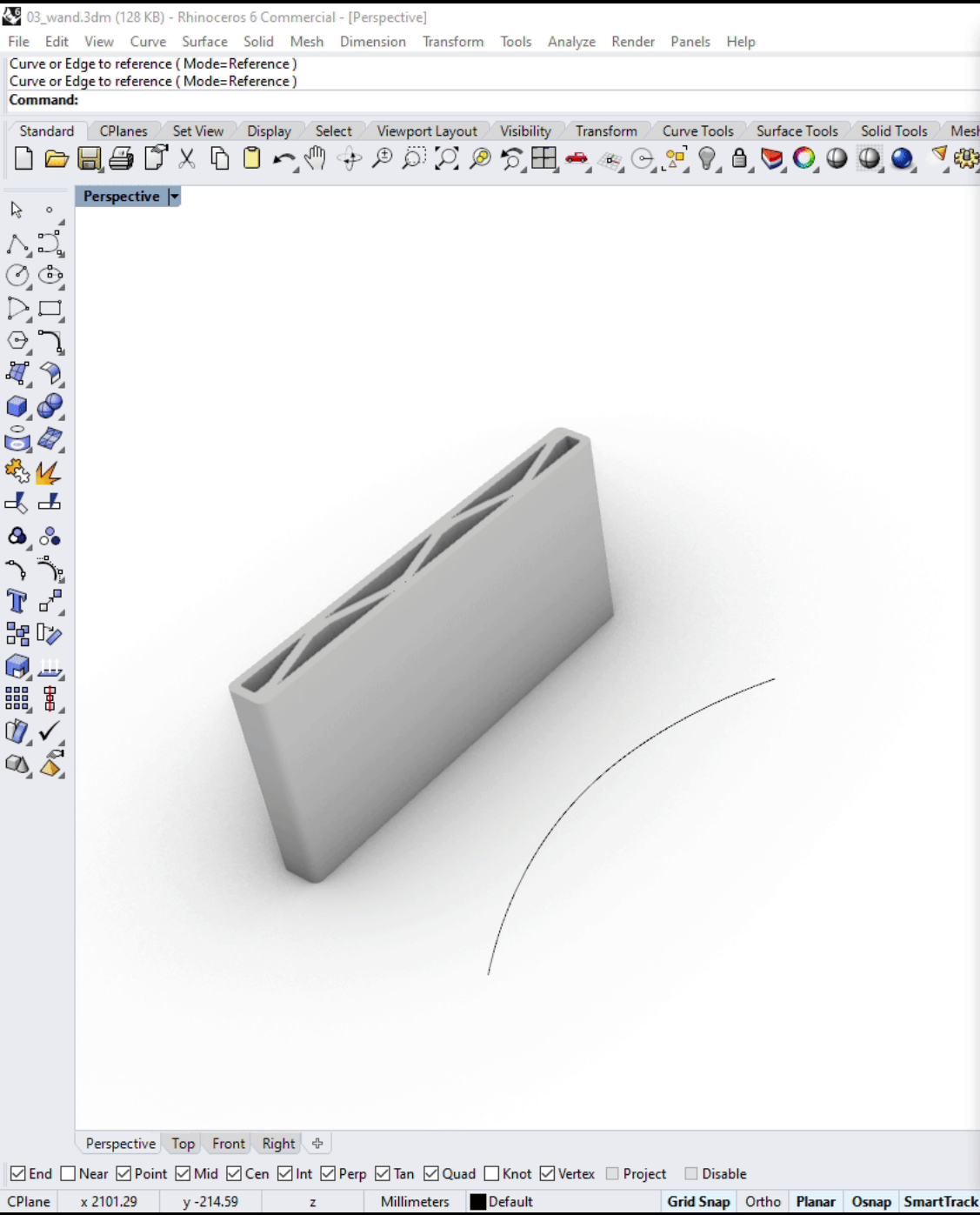
0:1 0:1

Min 0 Max 0

PARAMETRISCH DESIGN

Toepassingen in 3D-betonprinten

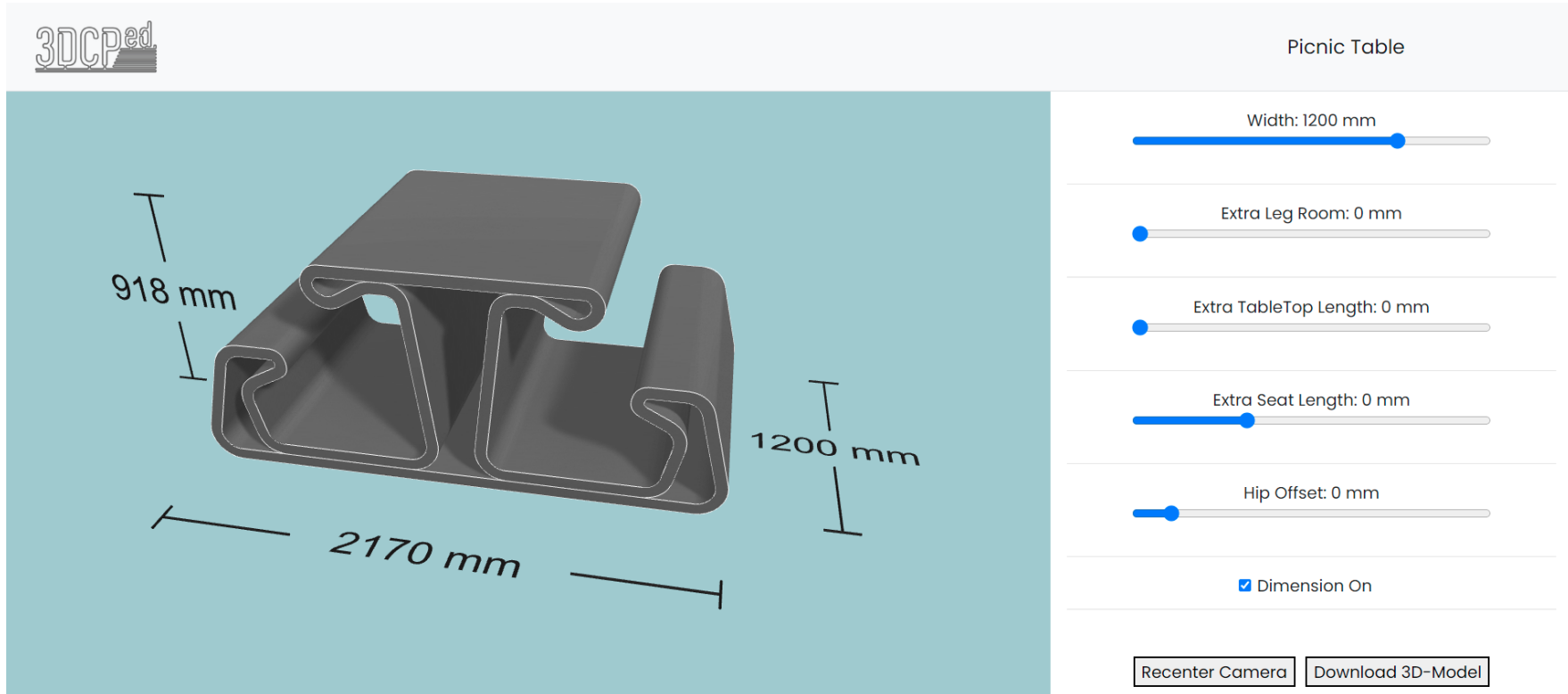




PARAMETRISCH DESIGN

Commerciële toepassingen

- Witteveen + Bos South East Asia (Singapore)



3DCPed

Picnic Table

Width: 1200 mm

Extra Leg Room: 0 mm

Extra TableTop Length: 0 mm

Extra Seat Length: 0 mm

Hip Offset: 0 mm

Dimension On

Recenter Camera Download 3D-Model

918 mm

2170 mm

1200 mm

PARAMETRISCH DESIGN

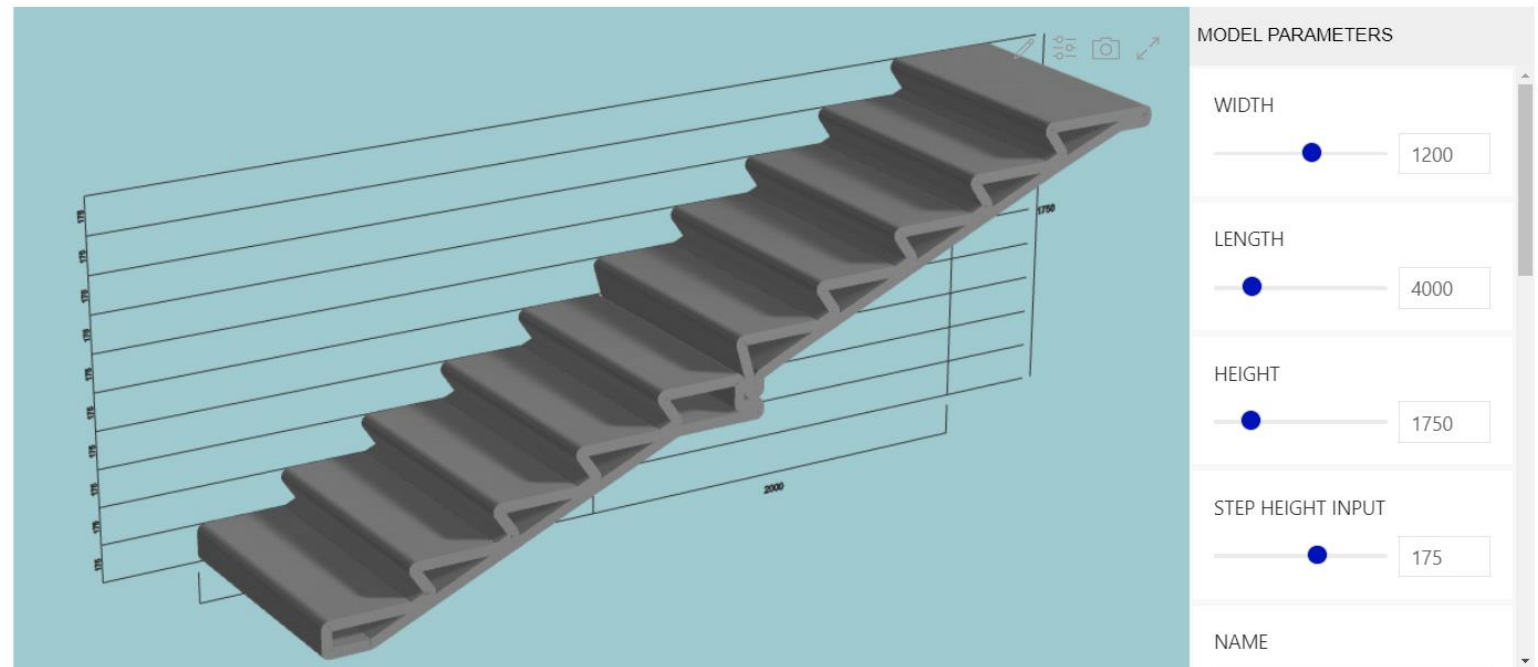
Commerciële toepassingen

- Weber


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[Design Guidelines](#)
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Slopestairs

Our goal is to make 3DCP technology available for everyone by sharing our production capacity, knowledge and expertise regarding the development and application of 3DCP techniques. One of the key elements of 3DCP is a parametric design. All parameters of our slope stairs are captured in such parametric design. With this tool you can design a custom stair with only the input of parameters such as length, width and height of the stairs.



OVERZICHT PRESENTATIE

INHOUDSTAFEL

- Print Software – Axel Boons
- **BIM-model naar PRINT-model – Wouter Bourgeois**
 - **Picture-to-print**
 - **Werkvoorbereiding C3PO project**
 - **BIM-to-print toegepast**
- Bouw-technische details – Antonie Damad

PICTURE-TO-PRINT

Softwaretoepassingen

- Prototype printer en software
- Aanpakken complexe vraagstukken
- Multidisciplinair team
 - Bouw
 - IT
 - Elektromechanica

Picture-to-print

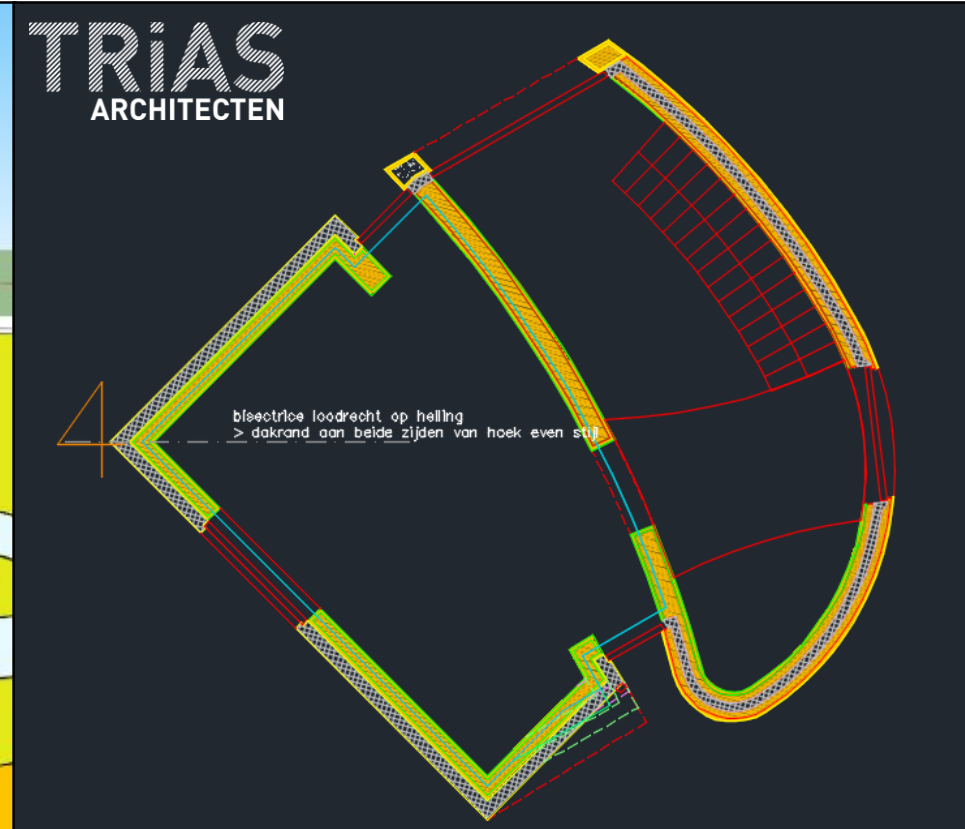
- Foto verwerken in oppervlak
- Parametrisch object met foto
- Logo WWF
- Logo Concrete House



WERKVOORBEREIDING C3PO PROJECT

Architect

- TRIAS Architecten
- 3D Sketchup
 - Voorontwerp
- 2D AutoCAD
 - Architectuurplan



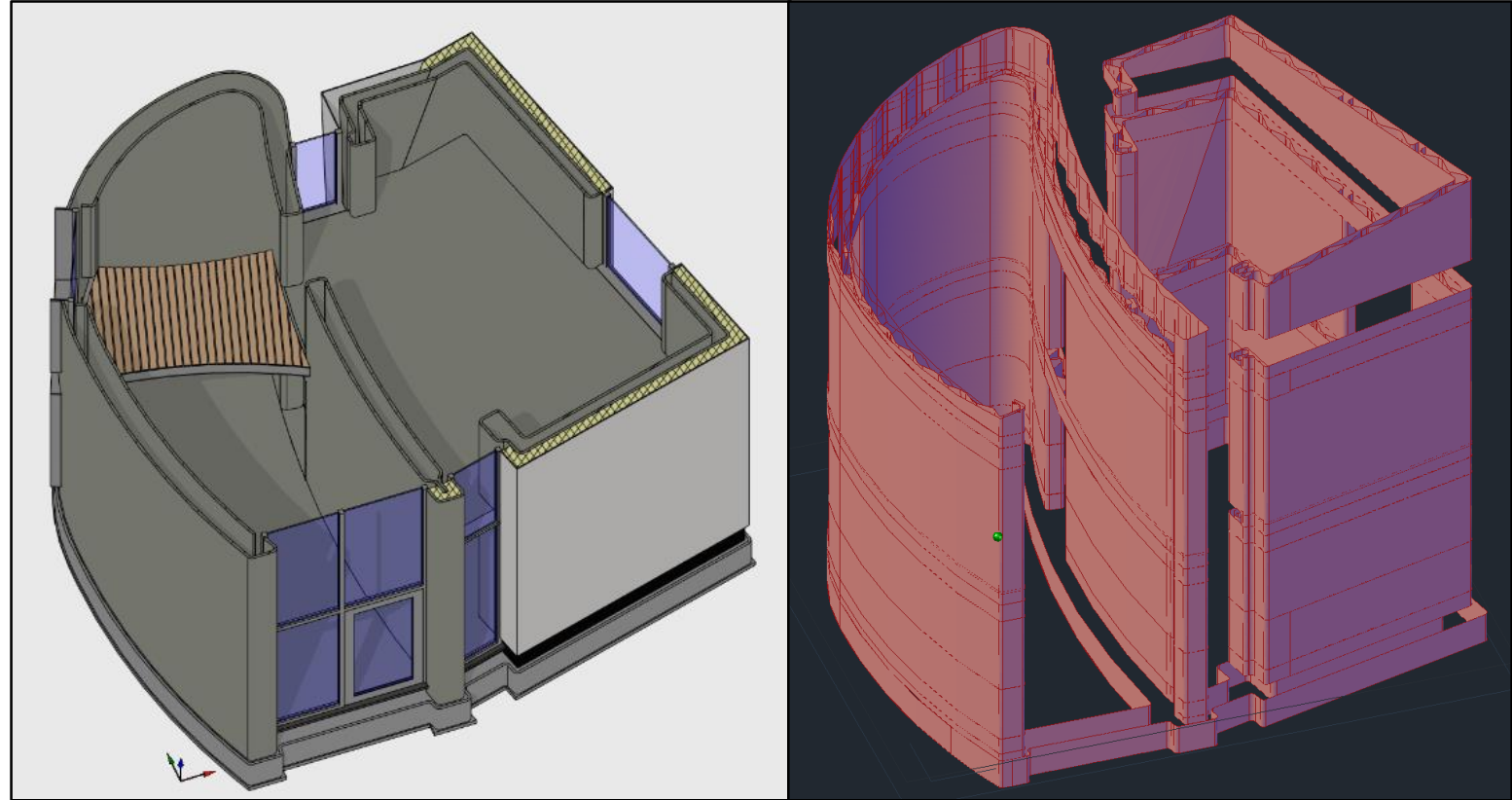
WERKVOORBEREIDING C3PO PROJECT

Aannemer

- Beneens Bouw & Interieur
- 3D Revit
- BIM model
- Coördinatie technische details

Printtechniekers

- Studenten Thomas More
- 3D AutoCAD
- Voorbereiding Slicersoftware



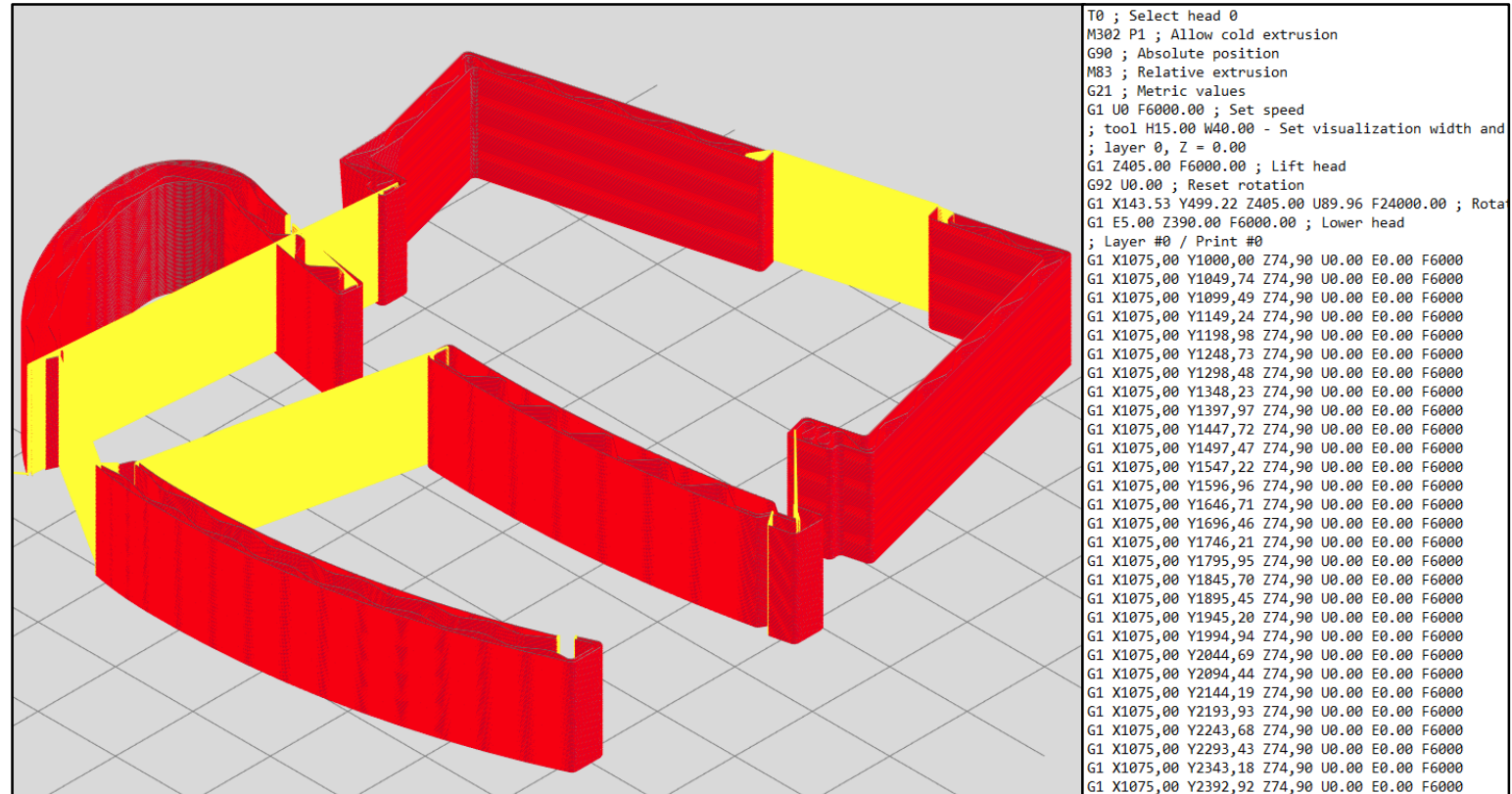
WERKVOORBEREIDING C3PO PROJECT

Printtechniekers

- Slicersoftware
- Instellingen printer
- 3D omzetten naar traject printer

Resultaat

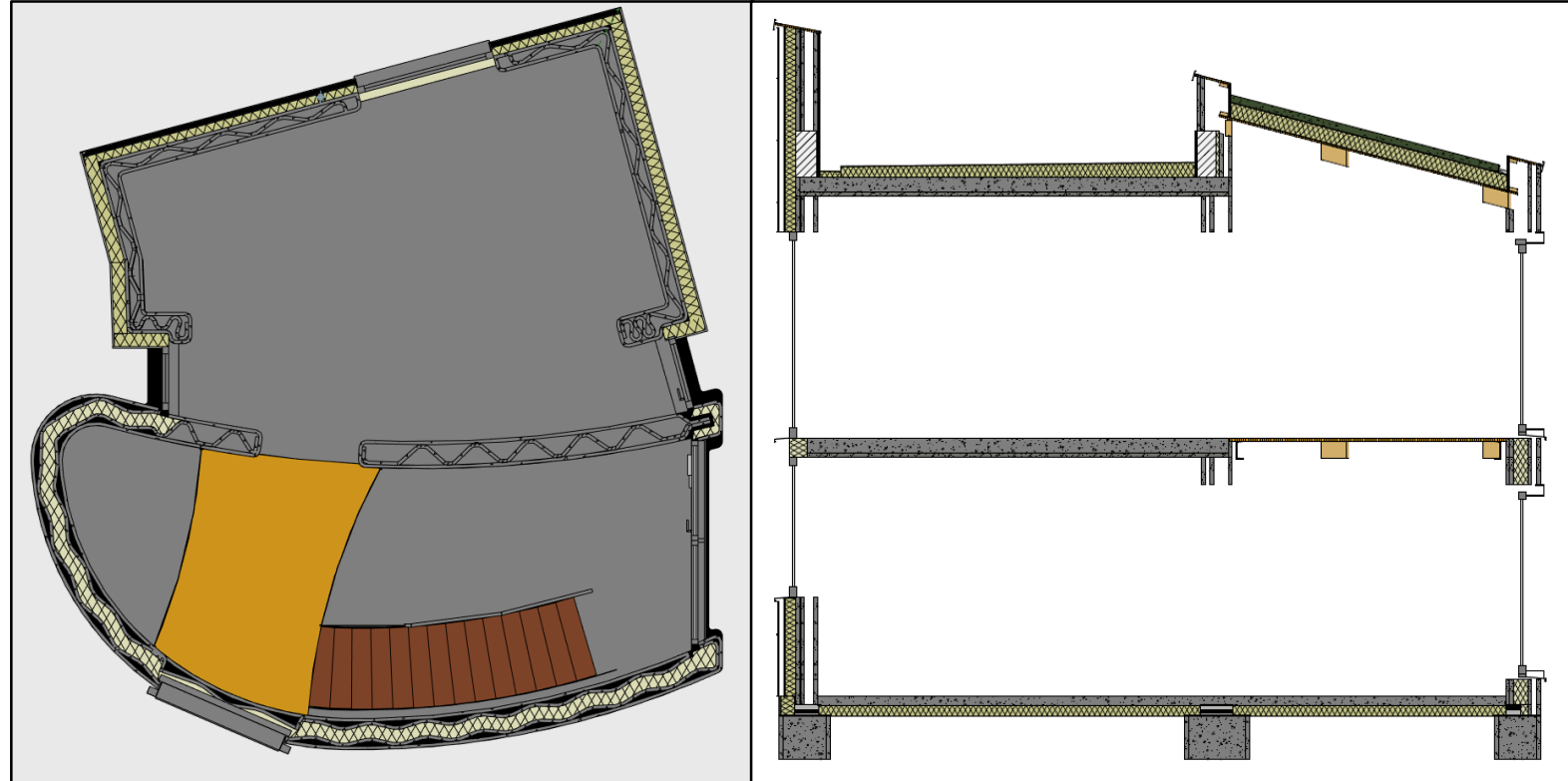
- G-code
- Printbestand
 - Coördinaten
 - Rotaties
 - Snelheid



BIM-TO-PRINT TOEGEPAST

Optimalisatie

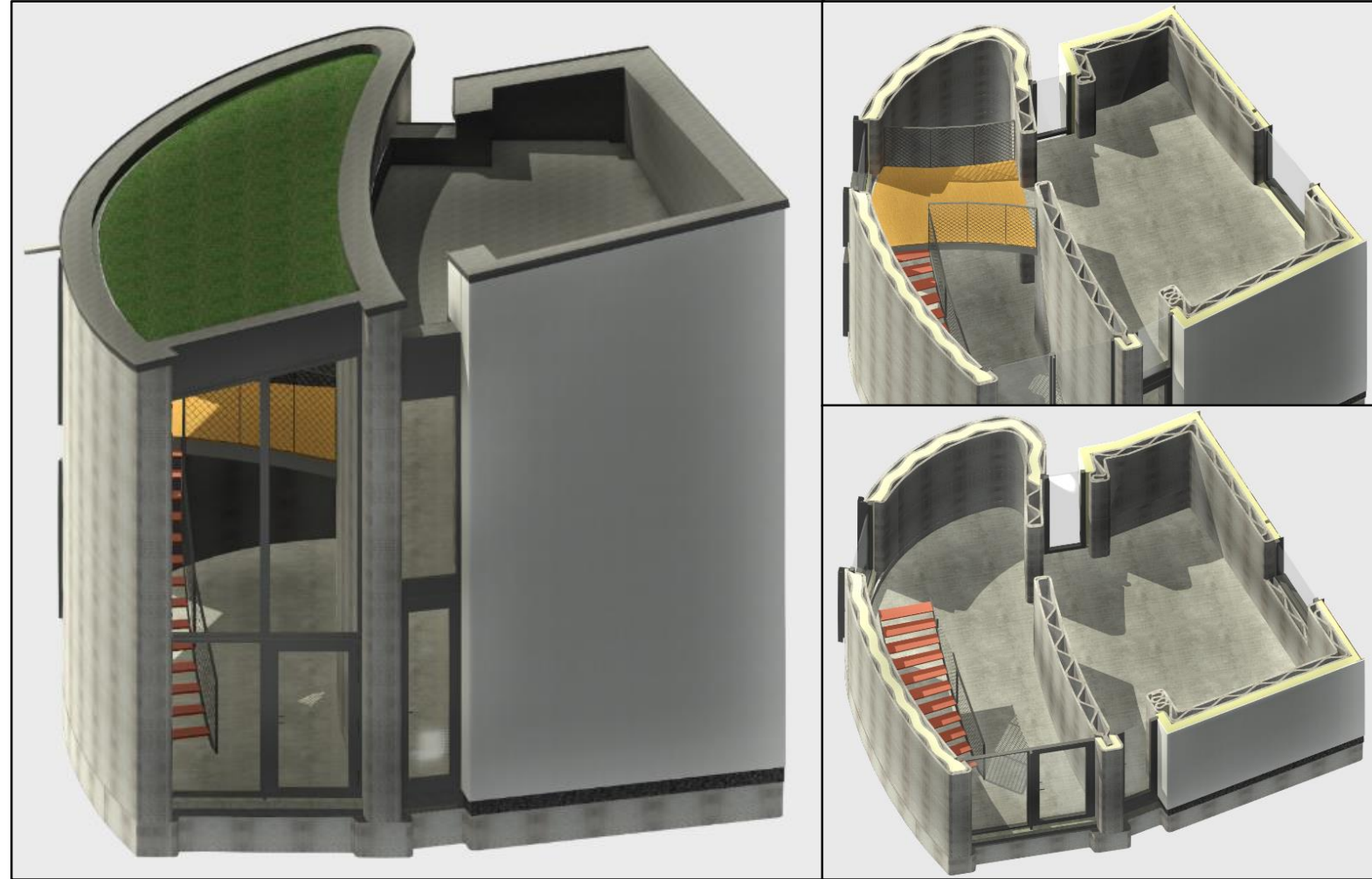
- Combinatie met BIM
 - 1 coördinatie-model
 - 2D plannen en snedes
 - Vlotte samenwerking OA
- Autodesk Revit



BIM-TO-PRINT TOEGEPAST

Print workflow

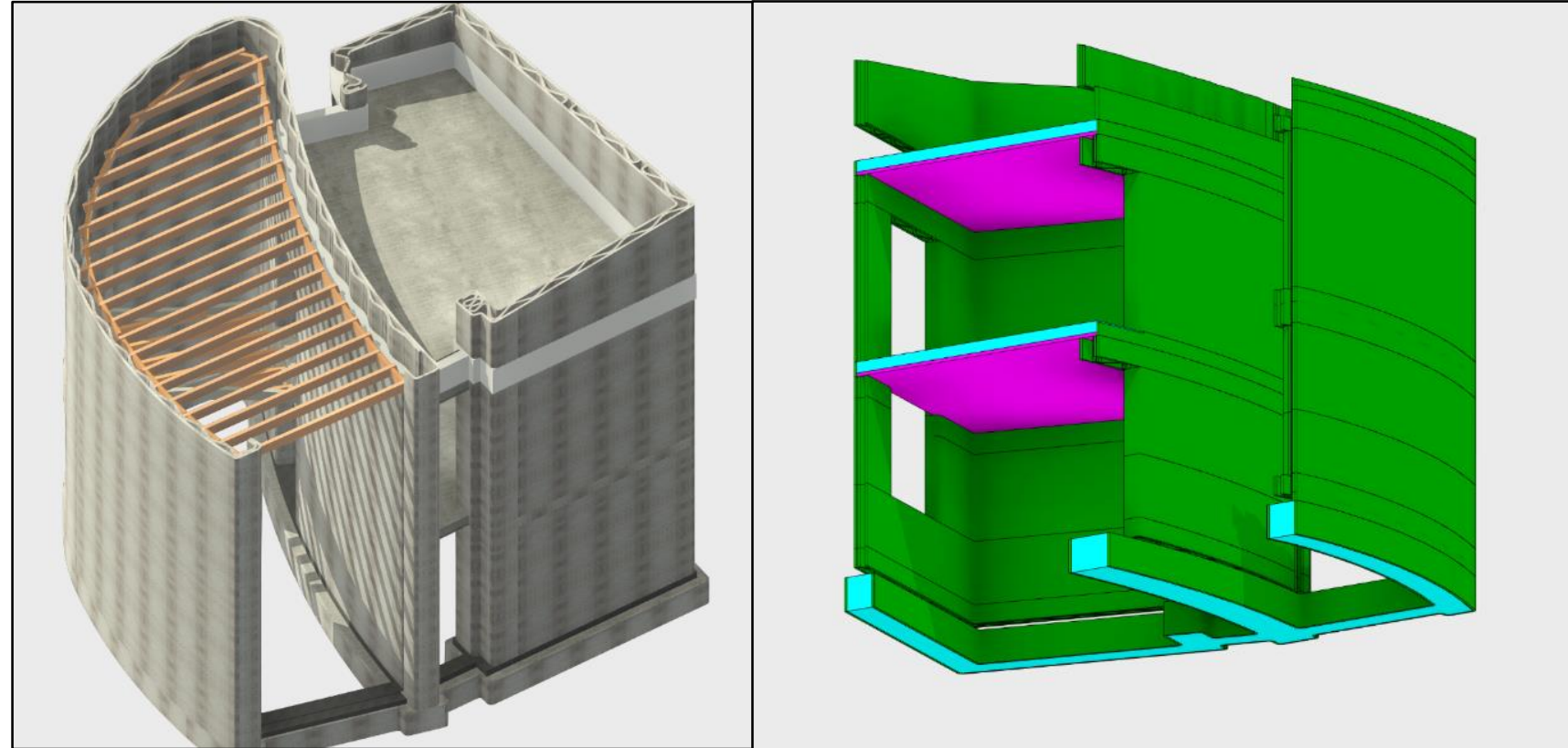
- BIM Architectuur
 - Basisregels
- Invulling wanden niet nodig
- Onderaannemer/printpartner



BIM-TO-PRINT TOEGEPAST

View filters

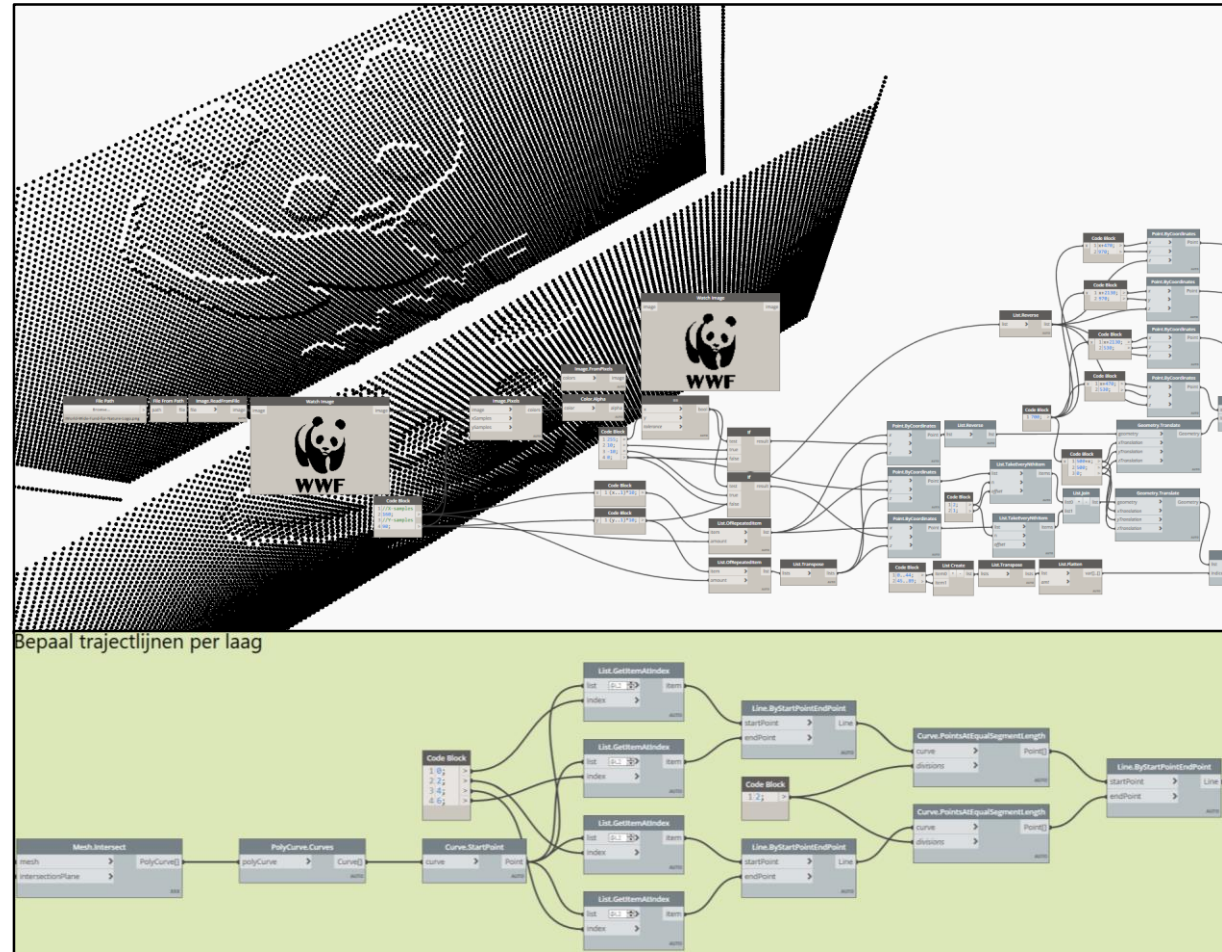
- Filter op structuur
- Filter op beton
 - Prefab – magenta
 - Gestort – cyaan
 - Geprint – groen
- Automatisch proces
- Nood aan standaarden



BIM-TO-PRINT TOEGEPAST

Dynamo (programmeersoftware)

- Missing link tussen BIM en PRINT
- Geïntegreerd in Revit
- Rechtstreeks aanmaken van G-code
- 6 stappen → 3 stappen
- Picture-to-print



OVERZICHT PRESENTATIE

INHOUDSTAFEL

- Print Software – Axel Boons
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- **Bouw-technische details – Antonie Damad**
 - **Ontwerp**
 - **Fundering, dragende structuur**
 - **Isolatie**

ONTWERP

Project C3PO

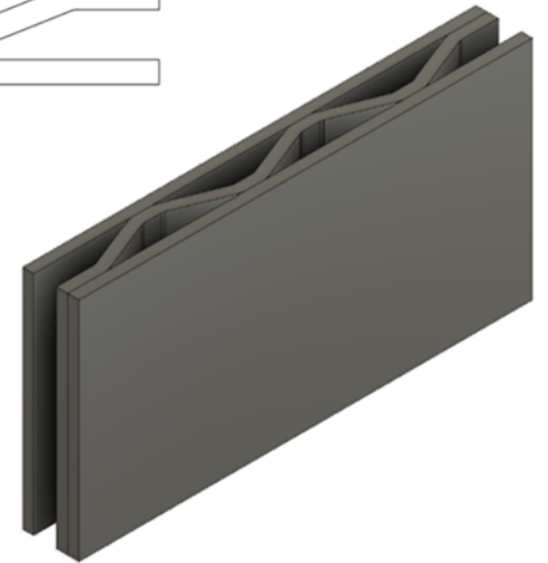
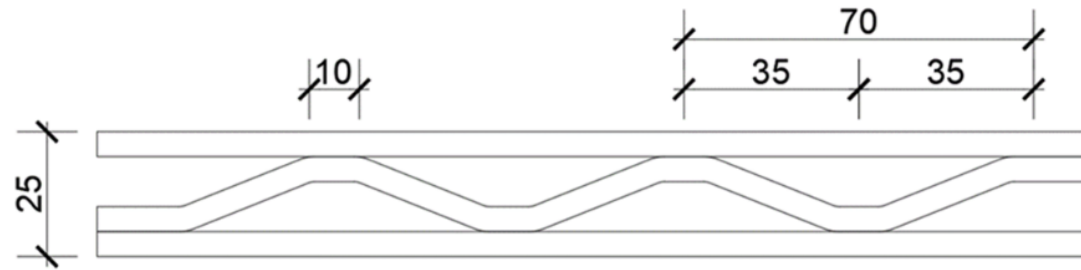
- Mogelijkheden van 3D-betonprinten in België
- Voorstudie demogebouw
- 10 printdagen



FUNDERING, DRAGENDE STRUCTUUR

Structuurwand

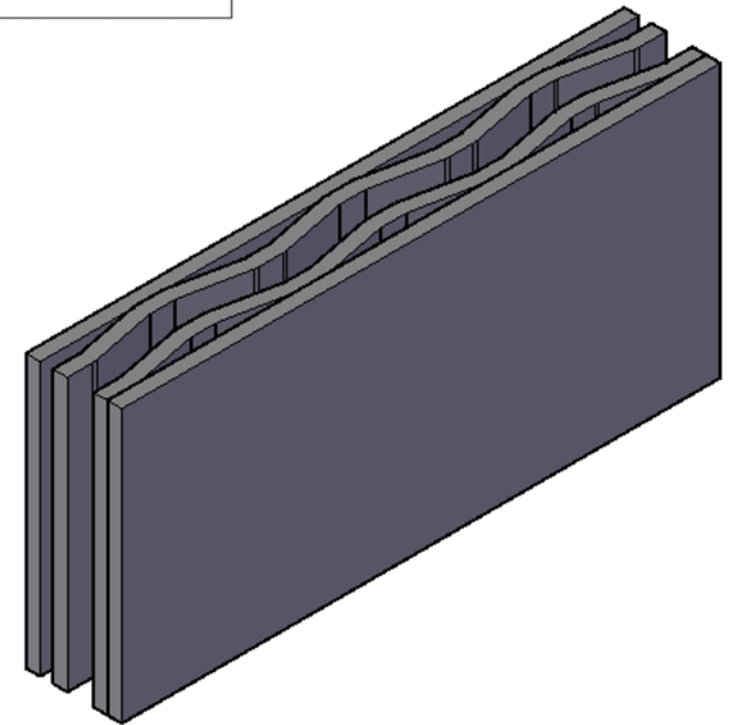
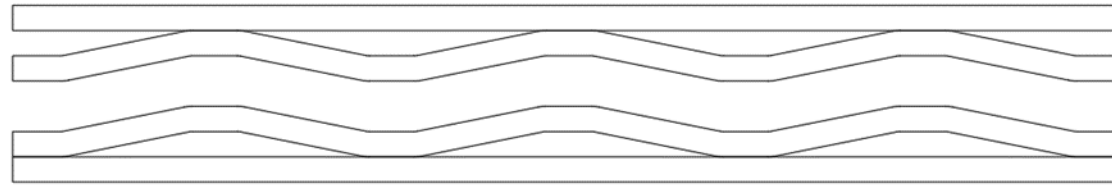
- Isolatie aan de buitenzijde
- Vrije invulling (Schacht technieken)



FUNDERING, DRAGENDE STRUCTUUR

Iso-wand

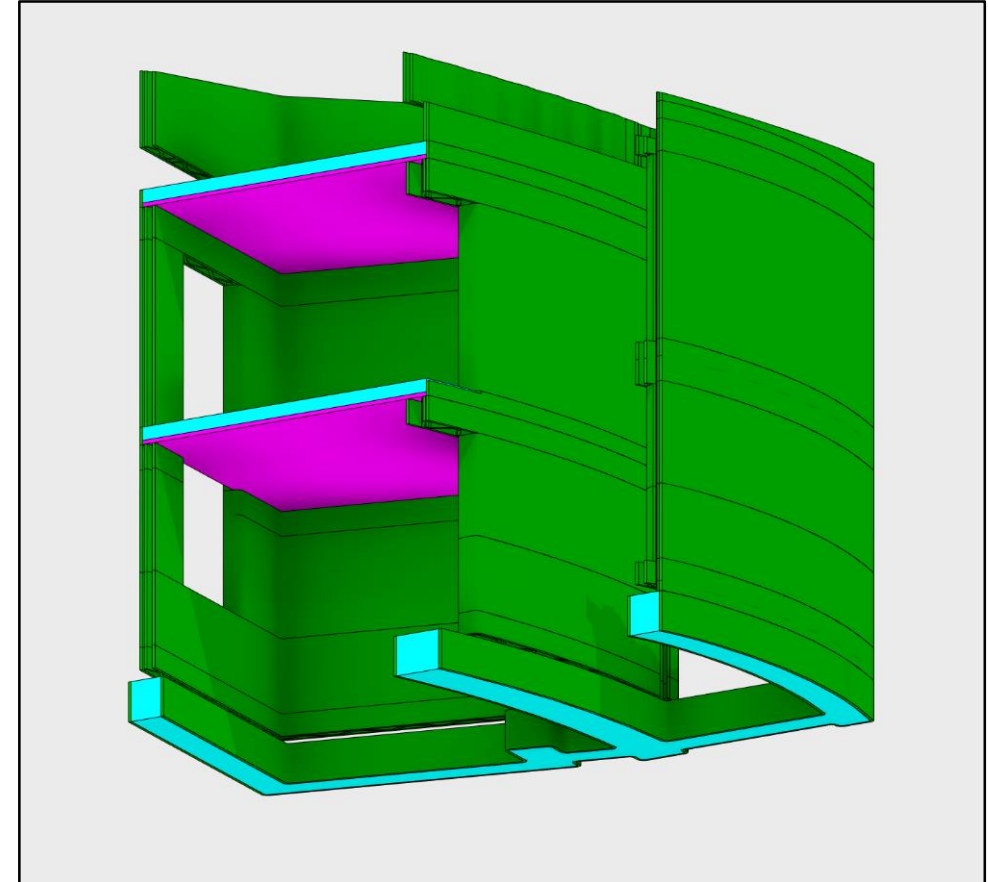
- Binnenschil en buitenschil
- Thermisch ontkoppeld met
- Volblazen met isolatie



FUNDERING, DRAGENDE STRUCTUUR

Overzicht betonelementen

- Zoveel mogelijk geprint
- Fundering = verloren bekisting
- Wanden = combinatie structuur- en isowand
- Vloeren = prédallen



FUNDERING, DRAGENDE STRUCTUUR

Sleuffundering

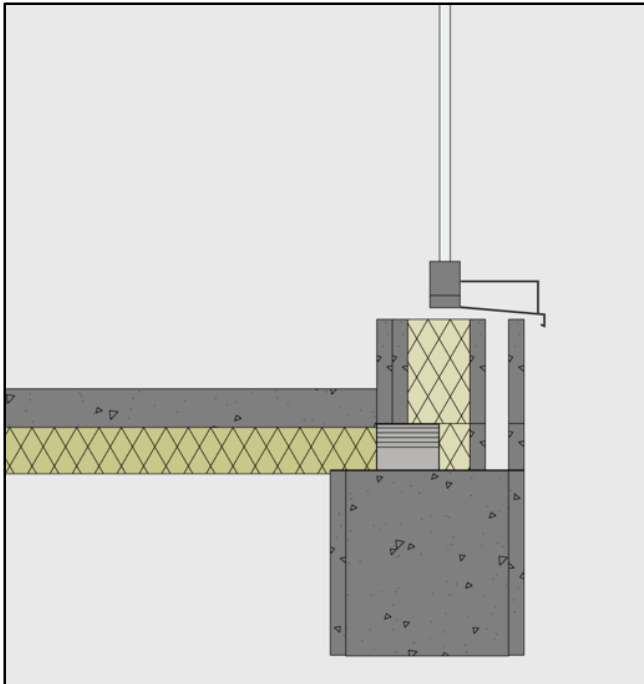
- Gebogen funderingsvormen
- Verloren bekisting
- Efficiënt materiaalgebruik



FUNDERING, DRAGENDE STRUCTUUR

Funderingsaanzet

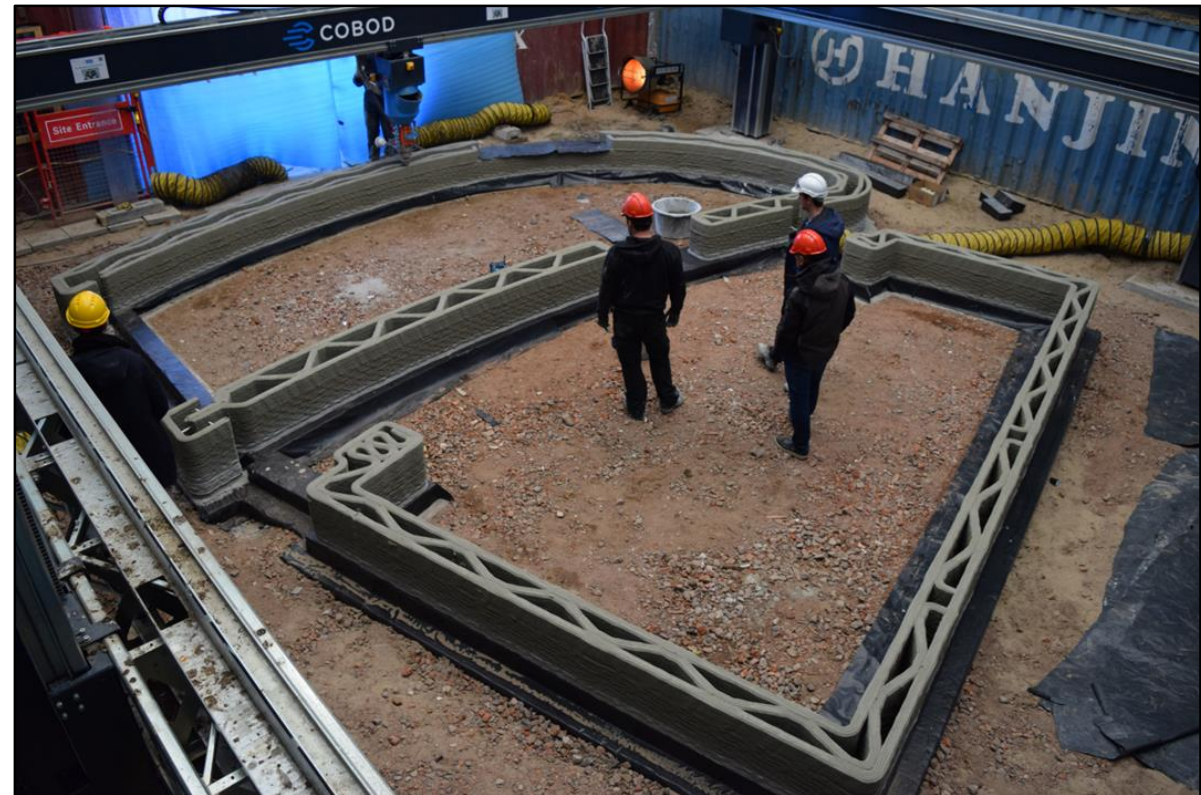
- Zonder koude brug
- Kimblok: Ytong of cellenglas



FUNDERING, DRAGENDE STRUCTUUR

Opgaand werk

- Schuine wand
- Integreren technieken



FUNDERING, DRAGENDE STRUCTUUR

Raam- en deuropeningen

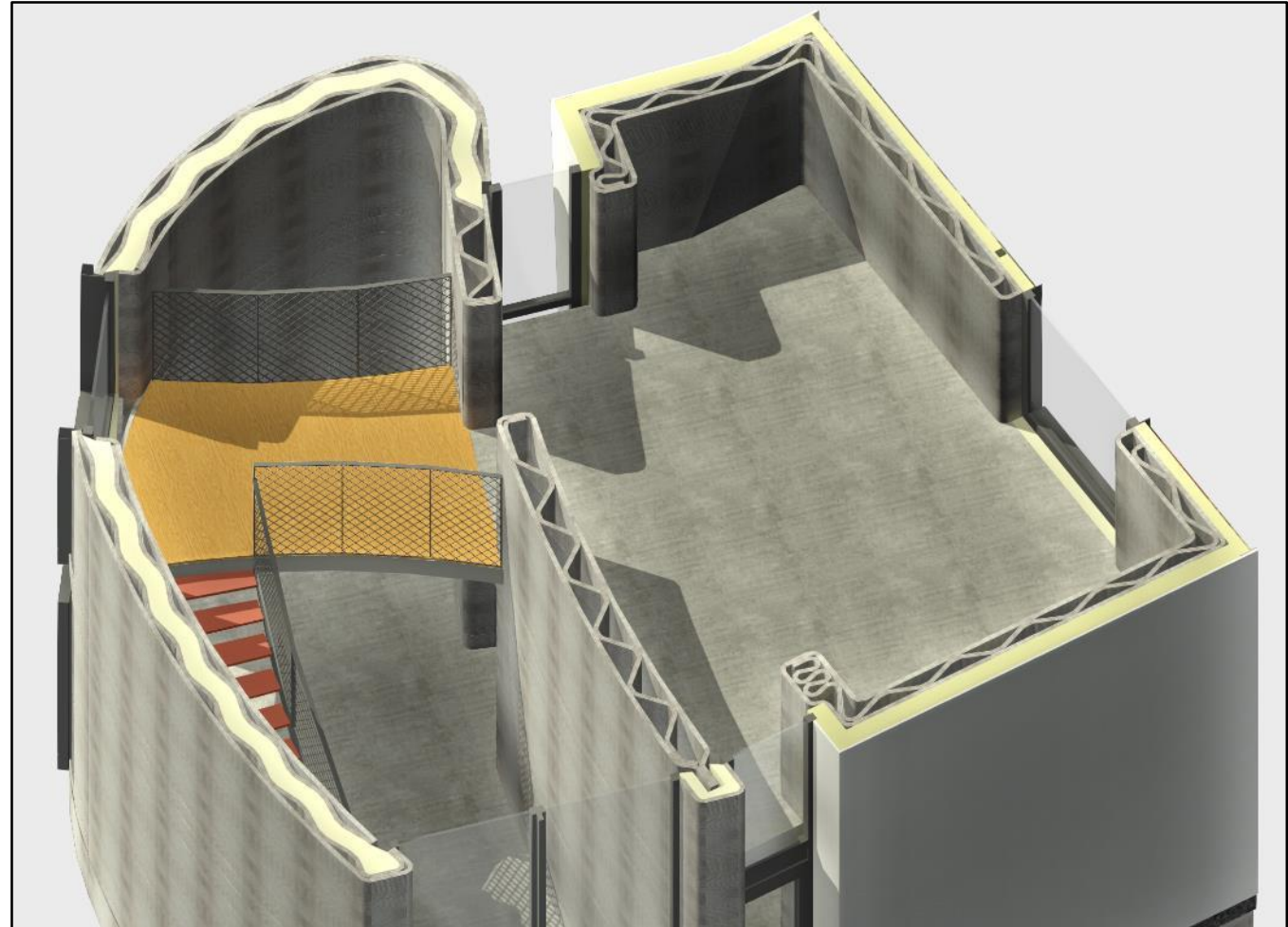
- Bekisting plaatsen tijdens printen
- Ingelegde wapening t.h.v. overspanningen



ISOLATIE

Ononderbroken isolatieschil

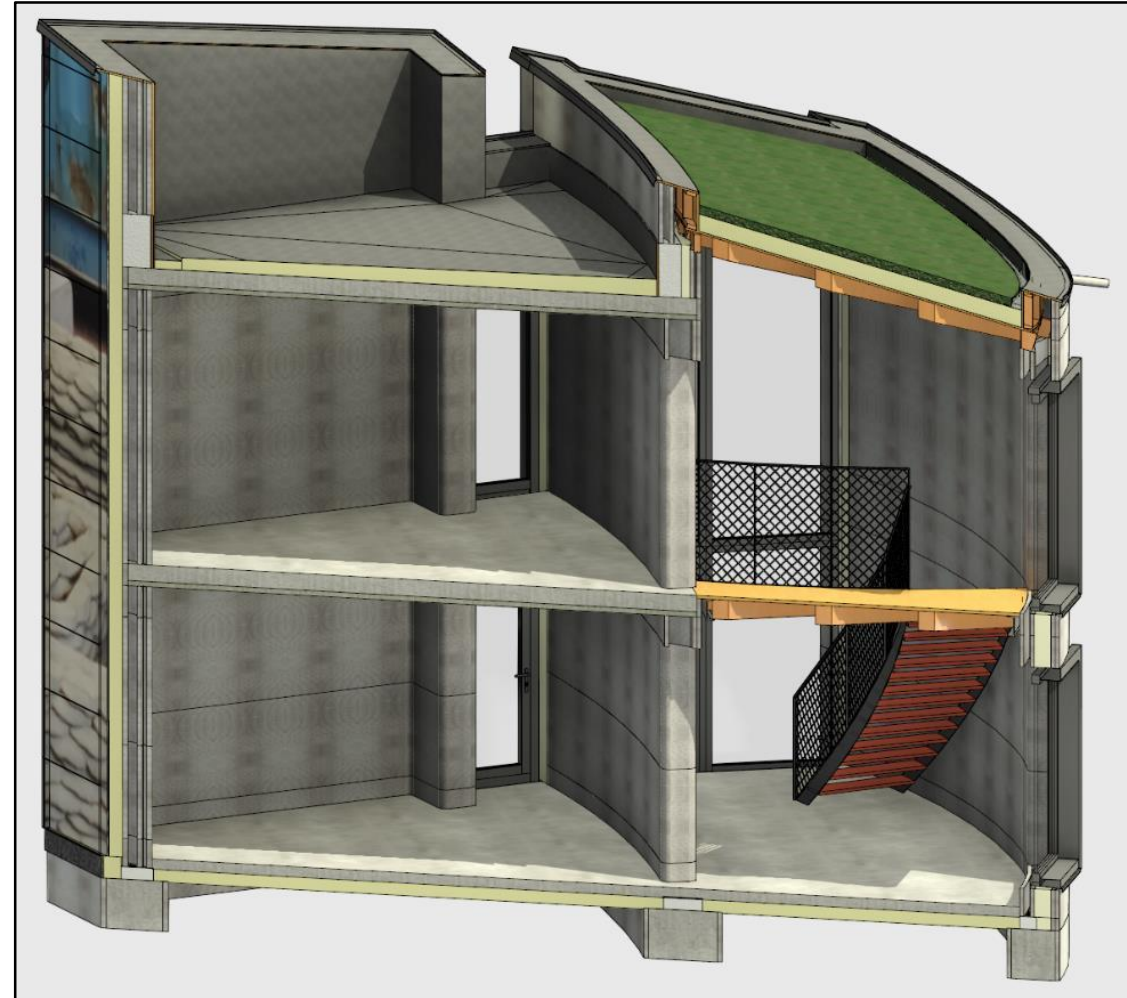
- Structuurwand
- Raam
- Isowand



ISOLATIE

Bouwknopen

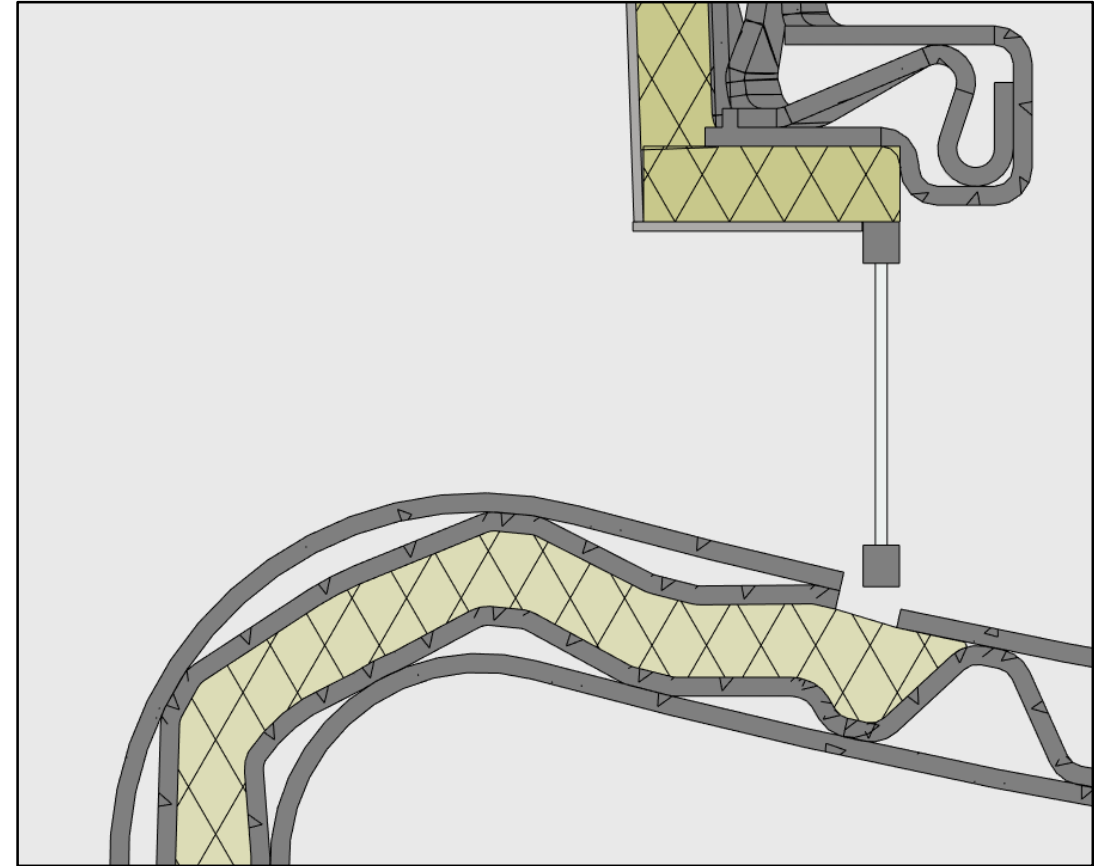
- Vloerisolatie – Cellenglas (kimblok)
- Cellenglas – wandisolatie
- Dakrand (ytong)
- Houten dakconstructie - isowand



ISOLATIE

Bouwknopen

- Raamaansluiting tussen structuur- en isowand



VAN BIM-MODEL NAAR PRINT-MODEL EN BOUW-TECHNISCHE DETAILS

EINDE

- Print Software – Axel Boons
 - Lector 3D-betonprinten – Thomas More hogeschool
- BIM-model naar PRINT-model – Wouter Bourgeois
 - BIM-manager – Beneens Bouw en Interieur
- Bouw-technische details – Antonie Damad
 - Lector 3D-betonprinten – Thomas More hogeschool