Oberhauser's Balloon: Parametric Control and Large-Scale Concrete 3D Printing

The **Oberhauser's Balloon**, developed by [Mangrove]() in collaboration with [Studio Oberhauser](), is an outdoor lighting element that merges architectural expression with large-scale additive manufacturing. Conceived as a sculptural object inspired by organic growth patterns, the design explores how digital modeling and concrete 3D printing can operate not merely as fabrication tools but as drivers of form, performance, and material identity.

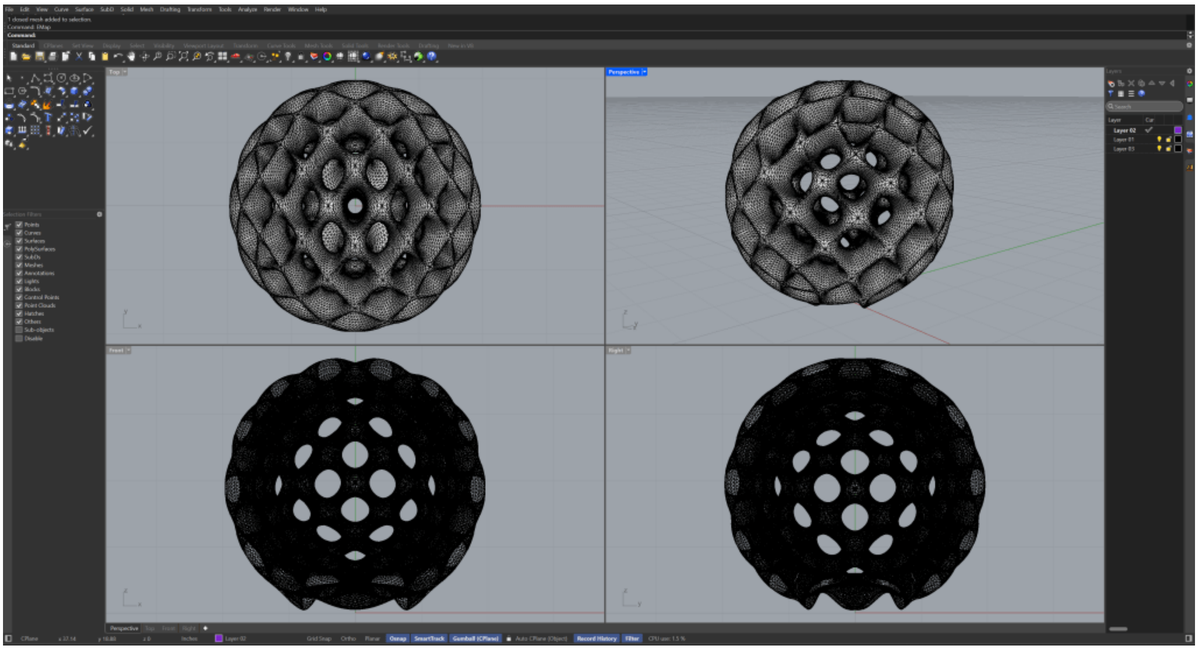
Available in three diameters, 11.5, 28, and 40 inches, the Balloon operates across scales, from landscape accents to architectural installations.

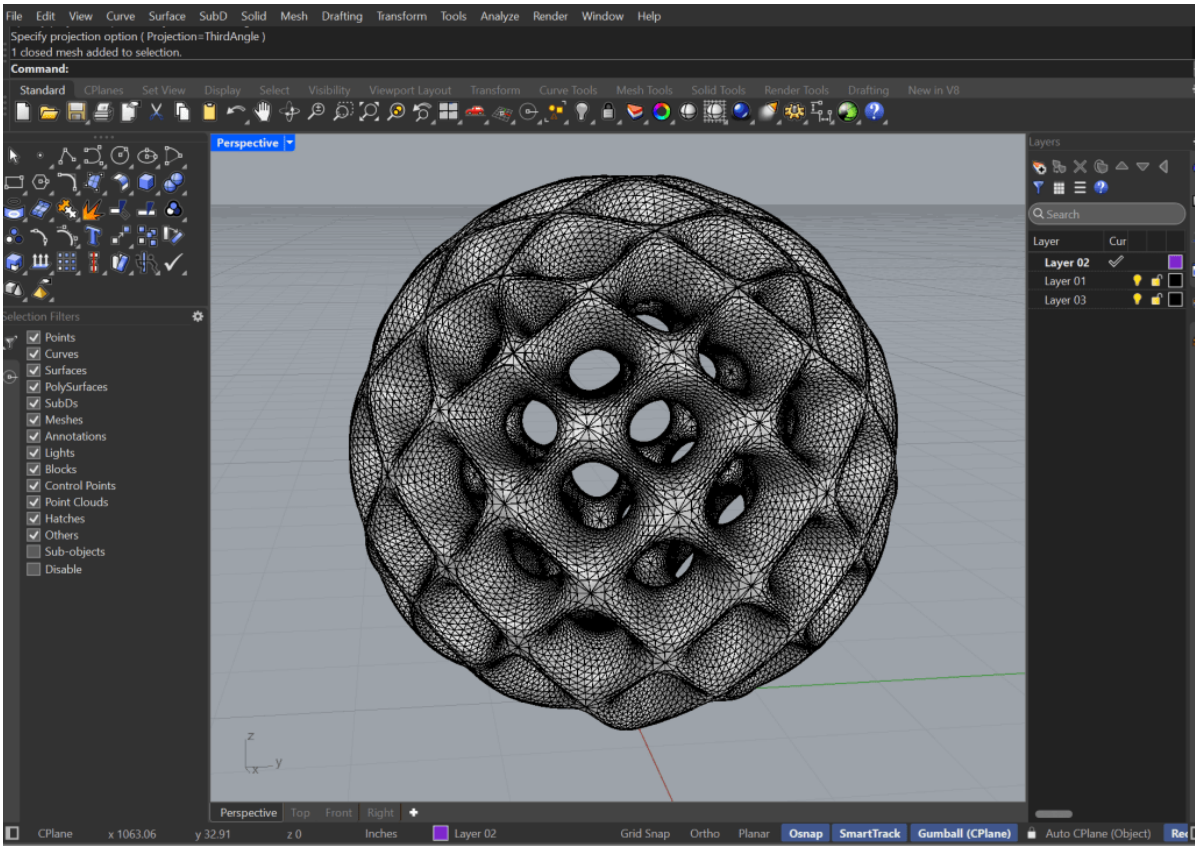
Available in three diameters, 11.5, 28, and 40 inches, the Balloon operates across scales, from landscape accents to architectural installations. The 40″ version is currently recognized as the largest 3D printed cement lamp of its kind. Rather than concealing the production method, the project makes the layered deposition logic visible. Subtle stratifications remain readable on the surface, echoing tree rings and reinforcing the connection between digital layering and biological growth.

The Balloon was fabricated using Mangrove's aggregate powder-bed concrete printing system, known as Selective Paste Intrusion (SPI).

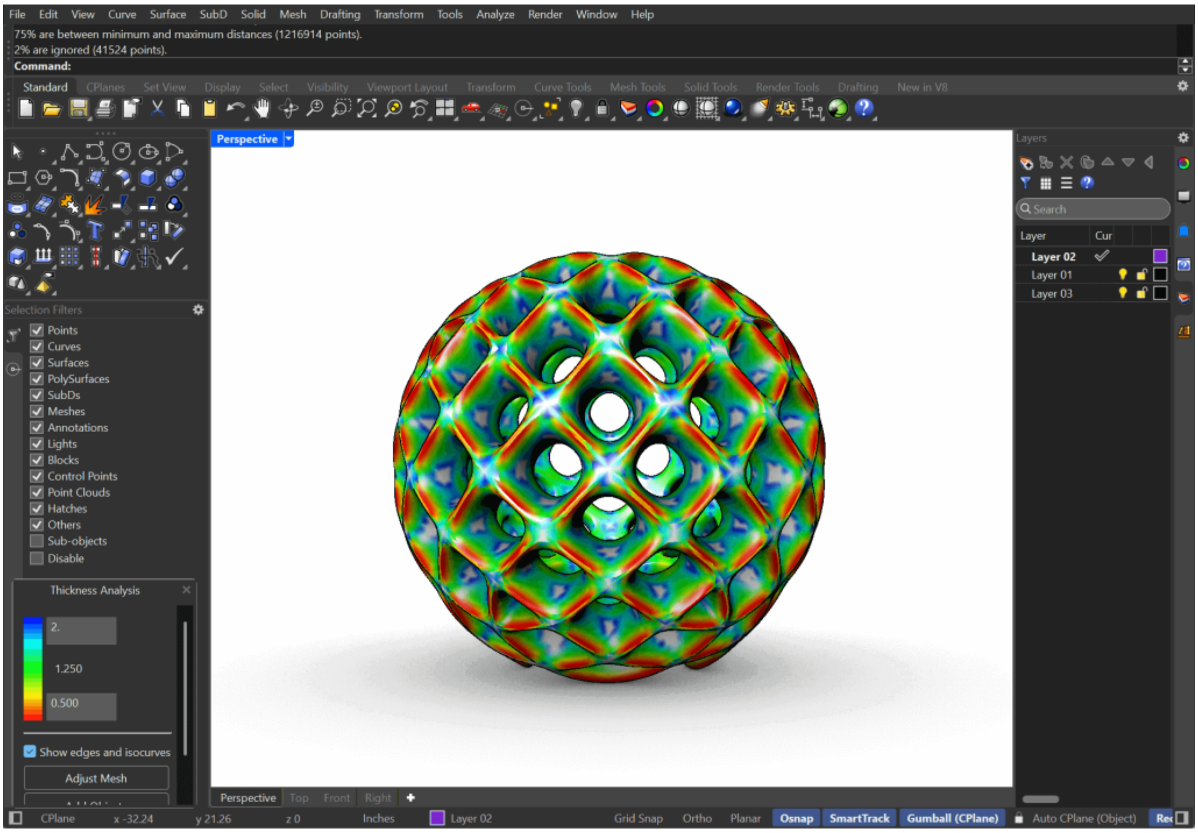
PARAMETRIC DEVELOPMENT IN RHINO & GRASSHOPPER

The design process was structured around Rhino and Grasshopper as the primary modeling environment. The team reconstructed and refined the base surface geometry through iterative remeshing, subdivision, and mesh offset operations. This approach allowed them to maintain parametric control over curvature, wall thickness, and internal void configuration while continuously evaluating structural and fabrication constraints.

- 

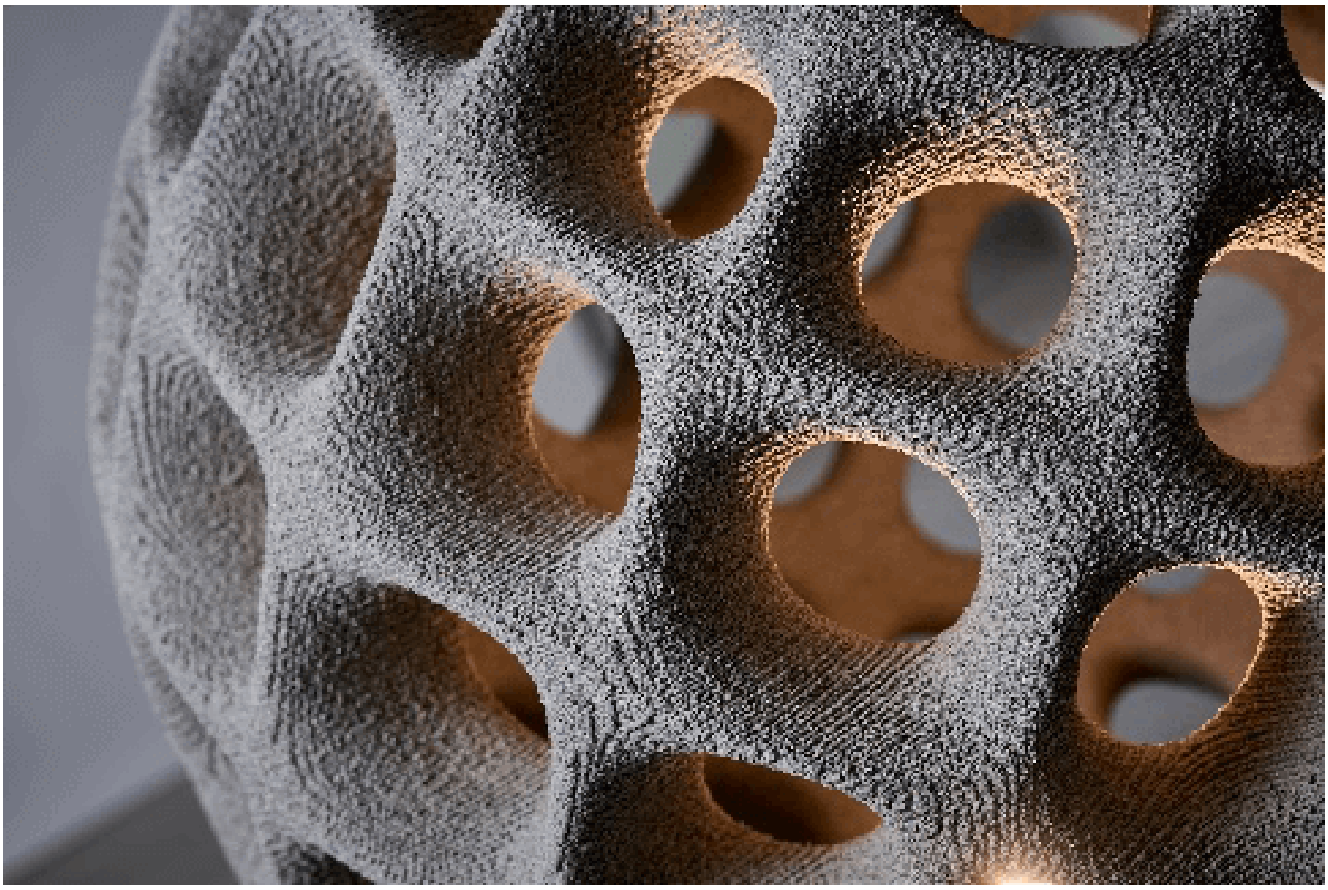
- 

File Edit View Curve Surface SubD Solid Mesh Drafting Transform Tools Analyze Render Window Help
Specify projection option (Projection=ThirdAngle)
1 closed mesh added to selection.
Command:
Standard CPlanes Set View Display Select Visibility Viewport Layout Transform Curve Tools Mesh Tools Solid Tools Render Tools Drafting New in V8
Perspective
Layers
Search
Layer Cur
Layer 02
Layer 01
Layer 03
Selection Filters
Points
Curves
Surfaces
PolySurfaces
SubDs
Meshes
Annotations
Lights
Blocks
Control Points
Point Clouds
Hatches
Others
Sub-objects
Disable
Perspective Top Front Right
CPlane x 1063.06 y 32.91 z 0 Inches Layer 02 Grid Snap Ortho Planar Osnap SmartTrack Gumball (CPlane) Auto CPlane (Object)

- 

The parametric framework enabled rapid generation of multiple size variants while preserving proportional relationships and visual lightness. As the form scaled up, wall thicknesses were recalibrated to minimize weight without compromising structural integrity. The model served not only as a formal generator but as a rationalization tool, ensuring that geometry remained compatible with the constraints of powder-bed concrete printing.

Early-stage validation occurred through FDM 3D printing, allowing the team to test geometry, tolerances, and lighting integration at smaller scales before committing to full-scale concrete production. This hybrid workflow reduced risk and enabled performance testing before final fabrication.



Conceived as a sculptural object inspired by organic growth patterns, the design explores how digital modeling and concrete 3D printing can operate not merely as fabrication tools but as drivers of form, performance, and material identity.

SELECTIVE PASTE INTRUSION & CONCRETE ADDITIVE MANUFACTURING

The Balloon was fabricated using Mangrove's aggregate powder-bed concrete printing system, known as Selective Paste Intrusion (SPI). In this process, cement paste is precisely injected into a bed of aggregate, bonding material layer by layer to form the final geometry.

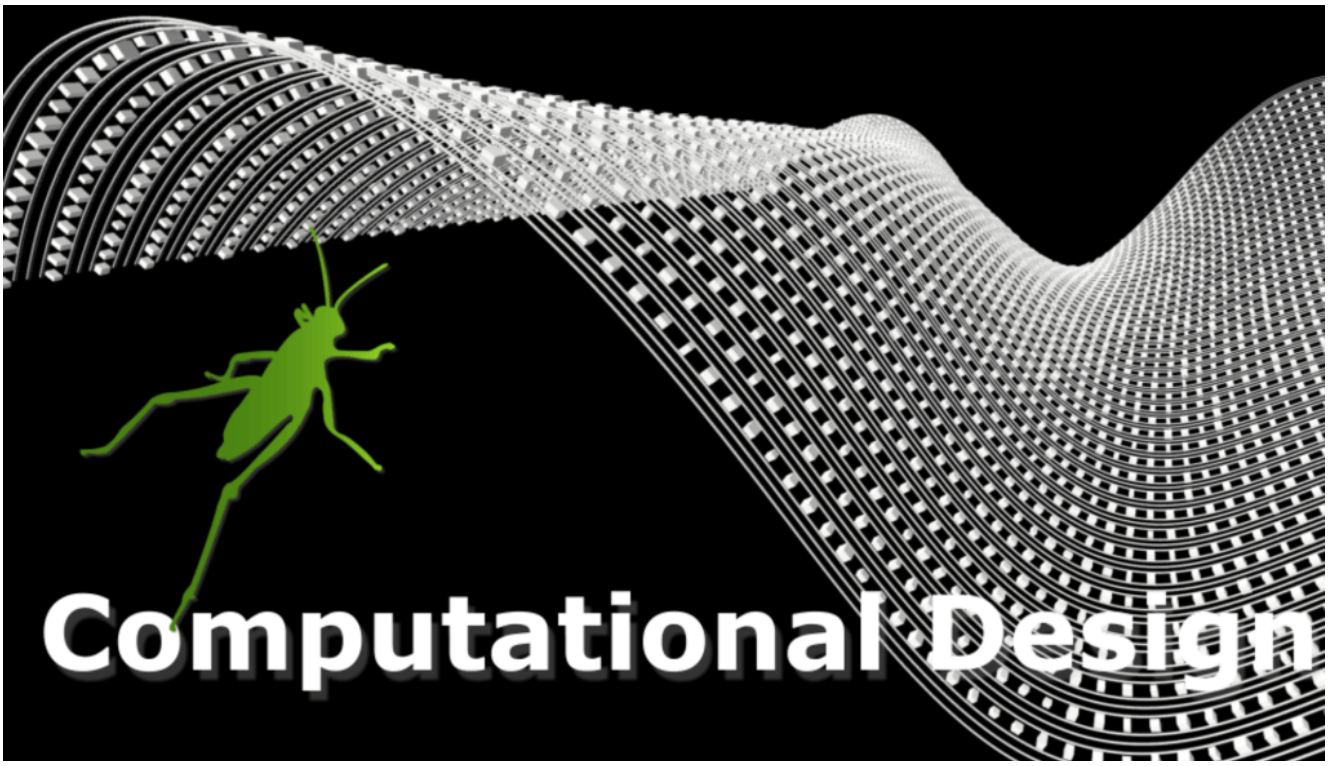
Unlike conventional casting, SPI eliminates the need for formwork or support structures. Geometry is defined directly through digital data, enabling complex internal cavities and nuanced surface articulation that would be difficult or cost-prohibitive using traditional molds. Material usage is tightly controlled: unused aggregate is reclaimed and recycled, significantly reducing waste compared to formwork-intensive methods.

The concrete formulation is engineered for durability and weather resistance, ensuring long-term performance in outdoor conditions. Whether functioning as a standalone lighting feature or integrated into landscape and water elements, the Balloon maintains structural stability and surface quality over time.

The Oberhauser’s Balloon, developed by Mangrove in collaboration with Studio Oberhauser, is an outdoor lighting element that merges architectural expression with large-scale additive manufacturing.

TECHNICAL CHALLENGES & RESOLUTION

One of the primary challenges with the project involved scaling the geometry across three sizes while preserving proportional integrity and aesthetic coherence. The parametric model allowed dimensionally linked adjustments, ensuring that curvature transitions and surface articulation evolved consistently across variants.



[See Also](#)

COMPUTATIONAL DESIGN WITH GRASSHOPPER

A second challenge centered on integrating a waterproof lighting system compatible with each scale. The design had to maintain formal clarity while meeting outdoor safety standards. Through coordinated development between design and engineering teams, an integrated lighting solution was developed that preserves the purity of the form while ensuring durability, compliance, and long-term functionality.

The project positions 3D printed cement not as an experimental novelty, but as a viable, precise, and sustainable production method for architectural-scale products.

By combining parametric modeling in Rhino with SPI concrete printing, the Oberhauser's Balloon demonstrates how additive manufacturing can expand the expressive and technical capacity of concrete. The project positions 3D printed cement not as an experimental novelty, but as a viable, precise, and sustainable production method for architectural-scale products.

CREDITS

Project: Oberhauser’s Balloon
Design Collaboration: Studio Oberhauser
Fabrication & Technology: Mangrove
Concrete Printing Method: Selective Paste Intrusion (SPI)
Parametric Modeling Tools: Rhino and Grasshopper
Prototyping: FDM 3D Printing
Leadership: Nathan Kerkstra (President), Greg Kerkstra (CEO)
Company Legacy: Founded in 2025