



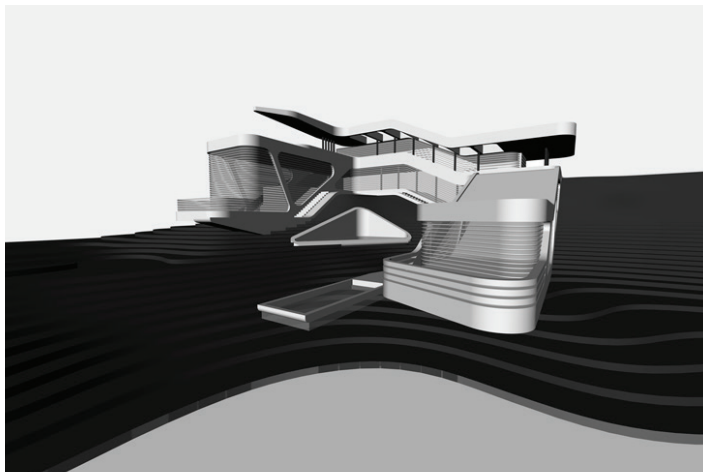
3D PRINTING A DETAILED MODEL IN 11 DAYS

COMPLEX ARCHITECTURAL DESIGN MADE
POSSIBLE WITH THE BIGREP STUDIO

THE ARCHITECT'S NEED FOR COMPELLING 3D MODELS

Most buildings, especially large or high-profile ones, are commissioned via a design competition. Often, a pivotal moment is the presentation of a large 3D model of one or more designs. To be successful, architectural teams need to offer a model that communicates a compelling vision of their concept to their audience, wowing them, intriguing them, showing off details, but also convincing them that it has been well thought out.

At present, large architectural models for presentation are usually produced by laser, hot-wire, or manual cutting of various sections of the model and then gluing them together. These models, built using cardboard, wood, Styrofoam or other materials, are often time-consuming and therefore labor-cost intensive to produce. This applies especially to the complex, organic designs which architects often create today with the aid of 3D design software. Architectural practices therefore face a trade-off between accepting large lead times and costs for a maximum specification model or reducing their ambition.



Manual model-building also carries inherent risks of time over-runs, errors and damage to delicate features. These problems can arise out of human error, whether due to a lapse in workmanship, a miscalculation, or the sheer difficulty of producing a certain form. Again, such issues are more likely with the kind of complex designs that 3D software allows, particularly when makers are trying to produce it to maximum specification.

OPTIONS ARCHITECTS FACE IN CONVENTIONAL LARGE-SCALE MODEL-MAKING



Overall, these cost, time and risk factors create a dilemma. On the one hand, simply spending more money will not necessarily get you more contracts. On the other, as architect Marco Mattia Cristofori points out, “However good your idea is, if you do not present it impressively and clearly at that clutch presentation, you will end up losing your chance to see it progress to the next stage.”



“ LARGE-SCALE MODELS ARE CRITICAL FOR AN ARCHITECT. TRADITIONAL METHODS ARE JUST TOO EXPENSIVE, CAN TAKE MONTHS TO REALIZE, AND MISTAKES TEND TO CREEP IN, MAKING THE WHOLE PROCESS LONGER.”

Marco Mattia Cristofori
Product Designer, BigRep

WHY NOT 3D PRINT A PRESENTATION-QUALITY MODEL?

“ I CAME UP WITH A DESIGN WHICH WOULD REALLY TEST OUT THE CAPABILITIES OF BIGREP TECHNOLOGY: TO 3D PRINT A LARGE, HIGH QUALITY ARCHITECTURAL MODEL.”

Marco Mattia Cristofori
Product Designer, BigRep

Marco Mattia Cristofori is an architect who completed his training at the Roma Tre University, with experience working at studios based in the UK, USA and Turkey. Shortly after joining BigRep as a product designer he set himself a challenge. He knew that many architects already used desktop 3D printing technology to produce small, early-stage models. After a short time working with BigRep's printers, Marco could see the potential of large-scale industrial 3D printers to produce large, complex objects highly accurately. Clearly BigRep printers could produce valuable early-stage models, but what about convincing presentation-quality pieces? Perhaps, they could surpass existing techniques. He decided to test his theory by designing a concept building and 3D printing it as a competition-entry-level 1:50-scale model.

Cristofori's creative process brought him to a design for a villa complex situated on hilly terrain: “I was inspired by the ‘organic forms’ found in some contemporary architecture, adding filleted corners, and inclining the building slabs to match the sloped terrain.” Aspects of the design meant 3D printing the model would be a great test for BigRep technology. The design minimizes on material use which produces a fragile overall structure. It contains many highly specified details, often repeated several times: rounded corners, a lip throughout the roof structure, repeat elements such as the light holes and recessed stripes. Precise, accurate and consistent production of these intricate features is necessary to achieve the full effect. And at 200 m², the design is big enough for a 1:50 model to be substantial in size.

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MAKE IT IN 1-2-3

Cristofori found making the model with a BigRep STUDIO was a straightforward three-step process involving 11 working days of making after completion of the design stage.

1 MODELING THE DESIGN ON CAD SOFTWARE

Since the Villa design was to be printed in full detail, the CAD model was used in its original form. Any exported 3D model file (STL/OBJ) is suitable for this task. Cristofori used *Rhinoceros*.

2 PRINTING THE DESIGN IN 12 SECTIONS

The CAD file was split into 12 sections, which were then 'sliced' using 3D printer software *Simplify 3D*. The sections were then printed on a BigRep STUDIO in BigRep's Mauer Grau. True Berlin Color PLA 3D printer filament. For a high-resolution finish, Cristofori chose a 0.6 mm nozzle and a print layer height of 0.3 mm. The total print time was 120 hours. Overnight printing, and allowing one working day for slicing, means this step could be done in just six days. It could have been even faster with different print resolution settings.

During this step, Cristofori integrated a 'snap-fit' solution into the design to make it easy to connect the sections together. This approach allows you to make modular design changes: altering and reprinting individual sections and then simply snapping them into place.

3 ASSEMBLY AND SURFACE FINISHING

The final stage was to assemble the sections and create the desired surface finish. Some printed transparent film and dowel rod sections were added at this point. Assembly was not a lengthy task and the high-resolution prints meant the model looked very good already. However, Cristofori decided to go for a smooth painted finish, manually post-processing by sanding and then painting external surfaces. Assembly and finishing required 5 full days' labor, with paint and glue drying time scheduled overnight.

Activity	Model-Making Time Required
Step 1: CAD Modeling	0 (follows from the design process)
Step 2: Printing the Design	6 Days (1 for Slicing, 5 for Printing)
Step 3: Assembly and Finishing	5 Days
Steps 1-3: Full Model Production	11 Days

I A DISPLAY PIECE

With the BigRep STUDIO, Cristofori produced a beautifully finished, high-impact model that could be imagined as a final competition entry. The printer rose to the challenge of producing a sturdy model that retained all fragile, intricate design elements – exactly as in the CAD file.

The lead and labor time required to produce this top-quality model was a lot less than we would expect under normal production methods. A conventional approach would be to laser cut cardboard in numerous sections and assemble these. Single pieces could be used for the flat facades, multiple layers glued together for corners and different solutions and improvisation for more complicated details.

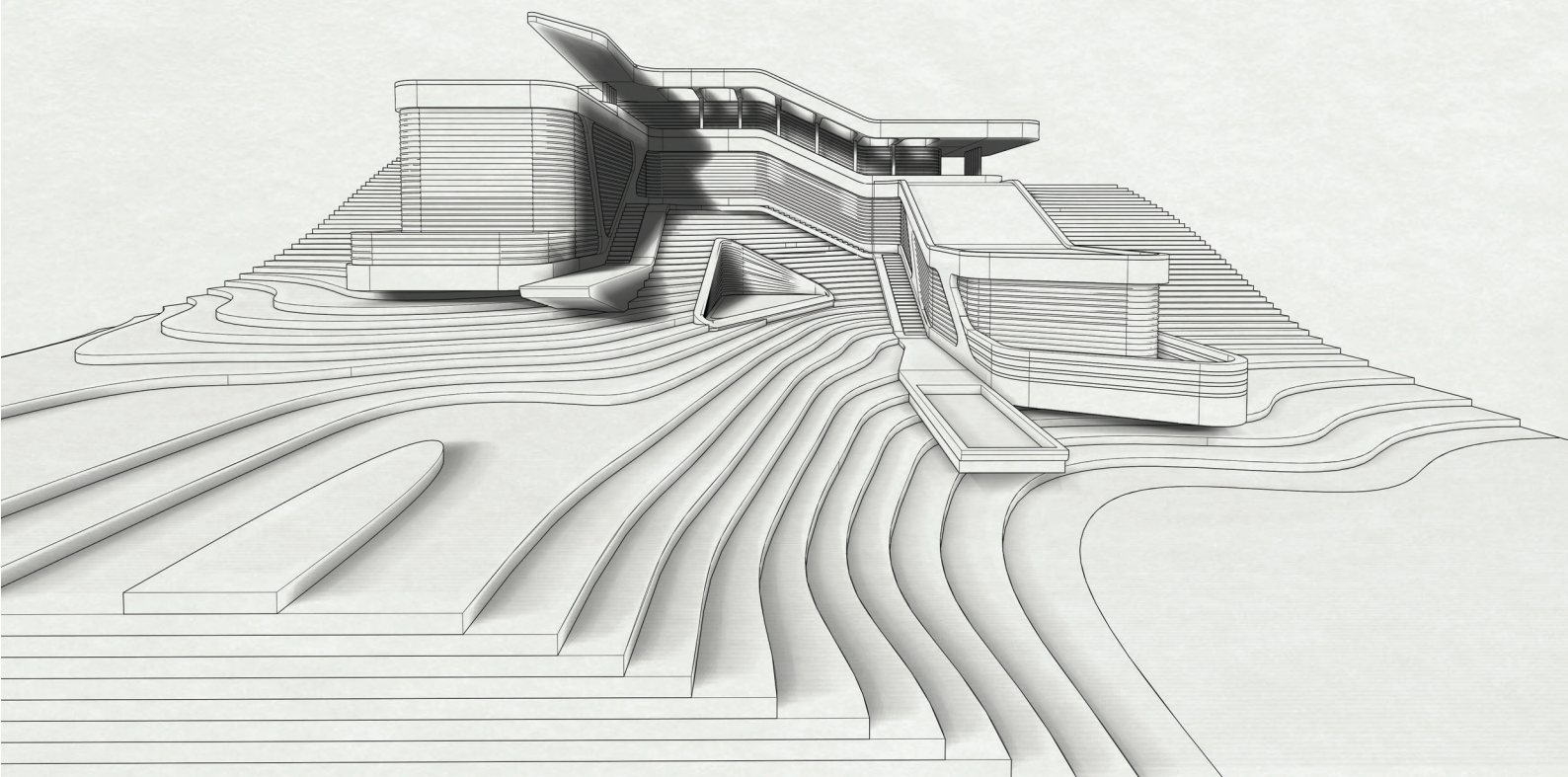
A typical architectural firm would give a model-maker a month to produce such a model according to Cristofori. The 11-day BigRep 3D-printed solution therefore represents a 50% cut in both production time and labor cost.

Furthermore, the highly-detailed, consistent and clean finish achieved in the BigRep model would be almost impossible to achieve with the one-month laser-cut approach. An increased time and money budget would make it more feasible but aiming for such a high-quality finish would also introduce new risks to the project.

All in all, the BigRep STUDIO delivered a great result, by printing complex objects quickly and precisely as it is designed to do. As Cristofori says: “If you are a designer or an architect with experience, you will instantly understand the amount of time saved using this technology to produce a physical model like this.” Architects will also recognize that this quality of model would be impossible to achieve with conventional methods without introducing further risks.

“FOR ARCHITECTS, 3D PRINT TECHNOLOGY IS NOT JUST A TOOL FOR RESEARCH, IT MAKES IT POSSIBLE TO PRESENT INCREASINGLY COMPLEX, CONTEMPORARY ARCHITECTURAL IDEAS TO KEY AUDIENCES IMPRESSIVELY AND CONVINCINGLY.”

Marco Mattia Cristofori
Product Designer, BigRep



“IN CONTRAST TO THE OTHER PRODUCTION SYSTEMS, IF WE 3D PRINT THEN WE DON’T NEED TO SIMPLIFY THE MODEL AT ALL. WE CAN RETAIN AS MANY DETAILS AS WE WANT.”

Marco Mattia Cristofori
Product Designer, BigRep

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THE USE CASE VIDEO

