



 3dpbm ×  COBOD

The real story on scaling 3D construction printing

COBOD's 3D construction technology and open-source material approach offer a unique opportunity to scale beyond one-offs, into large housing projects.

Learn how you can be part of a new world →

Introduction

COBOD is a globally leading company within the 3D construction printing segment. One of a few companies in this segment that has been making headlines in the press for the commercial projects completed by the many users of its 3D construction printers around the world.

Among others, they have completed the first 3D printed building in Europe, The BOD, in 2017 and Europe's first two- and three-story buildings when most still thought it would be impossible to 3D print multi-story houses. In 2019, COBOD printed the world's first 3D printed wind turbine tower for GE Renewable Energy. Now, the time has come for 3D construction to move past one-off projects and into large housing and building projects not limited to residential but also into commercial and industry segments where the benefits could be even greater. To do this, several conditions are needed, including: a reliable technology and technology supplier, a close global collaboration network between the technology supplier and its adopters and, perhaps most importantly, low-cost, locally sourced construction materials. COBOD has successfully built on all these fronts.

Types of customers

- Large companies that have the resources to think long-term, even if they do not turn immediate profits, and realize that this technology is going to have a significant market share over a longer horizon
- Innovative, entrepreneurial minded organizations that understand this is the future and want to have a front seat in it. They accept that they are making an investment in acquiring valuable experience
- Precast/concrete/cement plants that have realized that 3D construction printing will be part of the future due to the many advantages, including less use of labor, higher speed of execution and form freedom
- Universities & other R&D institutions wanting to become involved in state-of-the-art construction technology

Early signs of 3D construction printing's potential

- 1 - A huge interest around the very first trials of 3D printing applied into construction
- 2 - The technology initially available was still very immature and could be improved significantly
- 3 - Some of the largest construction companies began investing in either startups or their own ventures into 3D construction printing, even as they still did not fully understand the process

Understanding the business potential

Before building the company, COBOD founder Henrik Lund-Nielsen and a handful of employees conducted a major study on this sector on behalf of the Danish government. At the time he identified three factors that led him to believe that this market could grow into a major business opportunity.

Scaling hardware by opening materials

Cost comparison

Industry standard costs (based on dry-mix mortar) of construction 3D printing materials

- \$320–650: current cost of 1 ton of mortar for 3D construction
- \$16,000–32,000: typical cost of mortars for a small house with 3 bedrooms, 2 bath rooms
- \$480,000–980,000: typical cost of mortars for a 30 houses project

One element that differentiates COBOD from many other 3D construction printing technology providers is that they only sell the printers including the software and related concrete equipment, such as pumps and mixers as a total turn-key solution. They do not execute commercial construction projects for a living. They only execute projects to demonstrate proof of concept of various application cases, such as the first building in Europe or the first-ever wind turbine tower. COBOD focuses exclusively on selling machines and partners with clients around the world instead of competing with them.

Partnerships also extend to material suppliers. By providing an open material system COBOD can work with multiple companies around the world to develop and offer the best possible construction materials at the lowest costs. The goal of lowering the cost of materials has led COBOD to introduce one of the biggest game changers for 3D construction printing. A partnership with concrete manufacturer CEMEX led to the ability to produce and use 3D printable concrete anywhere in the world based on locally sourced cement and gravel. This not only reduces the cost of the print material with 85-90%,

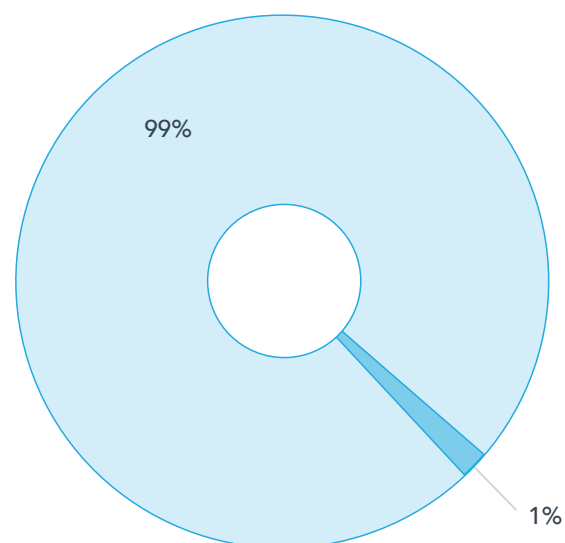
With COBOD's real concrete proposition costs are cut to 1/10th

- \$25–55: cost of 1 ton of COBOD 3D printable real concrete
- \$1,350–2,700: cost of COBOD 3D printable real concrete small house with 3 bedrooms, 2 bathrooms
- \$40,000–82,000: typical cost of COBOD 3D printable real concrete for a 30 houses project

but also means a much lower CO₂ footprint, as the cement-share in the recipe is lowered significantly compared to the 3D printed mortars done by virtually all other players in the market.

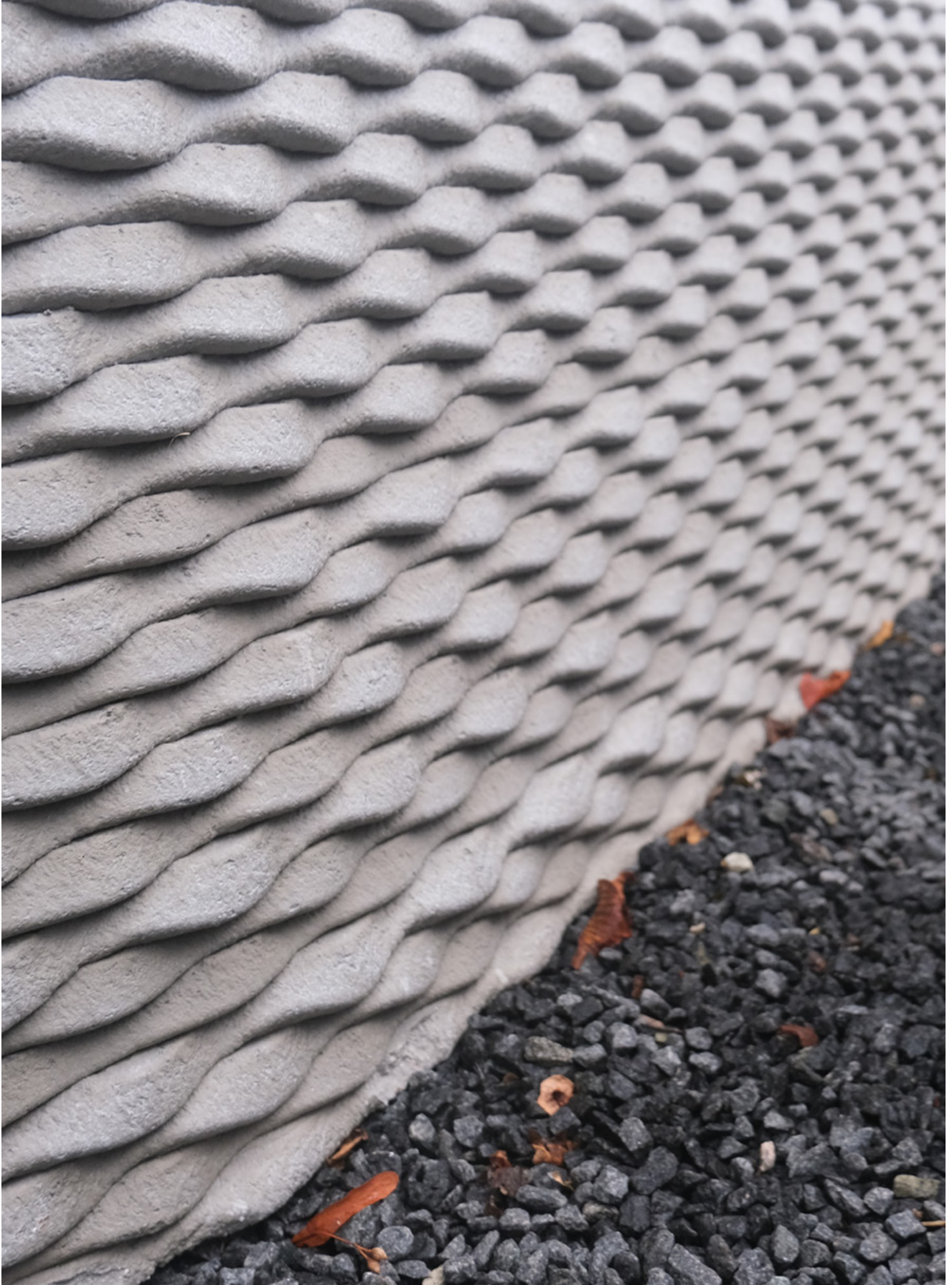
Real concrete: a game changer

- 99% locally sourced concrete materials, less transport/logistics time and cost i.e. lower CO₂ footprint
- 1% D.fab "Magic Mix" developed in cooperation between COBOD and CEMEX to make it printable









A new value proposition

**CAPEX for COBOD machines:
\$500,000–650,000**

Learning curve: 1 year

Profitability: After 1-2 years

Until today, the focus of 3D construction printing has been on residential housing, mainly one-story residential housing because that was what was possible to make in early years, when there were only small printers available. But with the much larger printers COBOD are now offering and much lower material prices this might no longer be the most attractive application for this technology. New applications in commercial and industry such as wind turbine towers as well as warehouses, schools and offices will see the competitiveness of the technology become even more evident, as these structures contain more concrete structures than the residential houses. This new value proposition is attracting construction companies and real estate developers, cement and concrete manufacturers all the way to large scale users such as civil engineering contractors and wind turbine manufacturers.

This is of fundamental importance because the CAPEX to acquire a COBOD system is not insignificant and takes time to generate profits starting at \$0.5 M for a complete turn-key solution incl. batch-plant and software. But it is justified by lower materials costs making payback time much shorter.

COBOD's history

COBOD doubled sales in 2020 and tripled in 2021 and even with significant profitability despite the rapid growth. About one third of sales are from repeat customers, a clear indication of the economic rationale for customers investing in these machines. Growth is very fast and more of the large players are moving in. Larger construction companies, larger concrete companies, larger cement manufacturer They are realizing that this technology is going to be a part of the future of construction.

Today, COBOD has the most printers sold around the world (close to 50) with several machines shipped every month. One reason for this is that the BOD2 printer system, launched in 2019, is tried and tested on several continents, and manufactured to high standards, which makes it a reliable choice to turn to COBOD for printers.

New customers reach out with specific challenges they need to solve, and COBOD assists them at no cost, helping them to understand how they can benefit from the technology and – perhaps more

importantly – to make sure they are aligned in terms of expectations. Potential adopters must understand that they need to their own learning curve and that there is going to be a learning process before they master the new technology and get the full benefit out of it. For one, construction printing conditions are not the same all over the world. In the Middle East the weather is very dry and hot. In Northern Europe it is very cold and humid. These different conditions imply different challenges that users must adjust to, with help from COBOD's experience developed by working with customers all over the world.

Overcoming misconceptions and challenges

One of the big challenges to 3D construction printing becoming more mature is that very few companies have a transparent and open approach, sharing real data along with experiences of good as well as bad practices. Some companies still favor an exaggerated narration about what their technology can do and what it theoretically could do. A large share of the market still promotes the misconception that anyone can get a printer and build a house in two days the first time, with minimum costs. That is simply not true. Another common misconception is relative to how much the geometric freedom of construction printing can reduce all the other costs

Common misconceptions

- Everyone can buy a printer and build a house in two days
- The cost of 3D printing a house can be reduced by 60-80%
- Geometric freedom can reduce all costs related to building a house
- Use 3D construction printing to replicate conventional designs done under the limitations of the conventional technology

COBOD numbers

~50: the number of COBOD printers sold LTD

Top-line growth: +100% in 2020, +200% in 2021

1/3 of business from repeat customers

Since launch in 2021, 70-80% of orders are based on the low-cost concrete materials solutions, not the expensive proprietary mortar solution proposed by most industry players

related to completing a building project: the technology is used to print the walls and sometimes the foundation and even the roof, but you still need doors and windows, plumbing and electricity among others. Perhaps the biggest challenge now is getting people to understand is how to design for 3D construction printing, for example preparing the walls so electricians do not have make cuts and can just rapidly install the sockets. The third fundamental challenge is addressing the fact that 95% of the interested companies want to start by 3D print a conventionally designed building, created under the limitations of the traditional construction industry.

COBOD is working to teach its clients to start thinking additive from the beginning of the project, such that they can get the full benefit from using the new technology, where they are not burdened by the limitations of the conventional solution.

Key challenges to address

- Fighting the hype
- Understanding the costs
- Finishing the building with systems and parts
- Re-thinking construction projects "additively"







Building the future today



Future goals

Targeting a much larger share of the construction market including larger buildings, schools, and commercial e.g., offices warehouses, etc.

From 2-3 story buildings to 6-7 story, 6,000 m² (64,583 ft²) buildings.

From 3D printers to multifunctional construction robots.

Ongoing projects carried out by COBOD clients all over the world continue to expand. The GE wind turbine tower has opened an entirely new application segment while PERI's 3-story house showed that multi-story buildings are possible. Other interesting projects are the first 3D printed school and house. Now 14Trees, a JV by Holcim, the world's largest manufacturer of cement, is working on a 32 units

complex, in Kilifi, Kenya and we will see more 30, 40, 100 and even 200-house projects. And that is where the real potential is: on one hand the large-scale projects with hundreds of units where low cost is key. On the other, the high-level design projects, leveraging the printer's ability to offer unique shapes and form freedom. In both cases, COBOD printers have shown that they can deliver.

"The future holds great things for 3D construction printing. COBOD expects the current strong growth trend to continue and accelerate in the next few years, with the ability to provide bigger and faster machines, targeting six or seven story buildings, even as soon as two years from now," Henrik Lund-Nielsen tells us. Future 3D printed buildings might be 25 m (82 ft) in width and 40 m (131 ft) in length, meaning 1,000 m² (10,763 ft²) per floor, times six floors. That is 6,000 m² (64,583 ft²) buildings as opposed to the up to 600 m² (6,458 ft²) done now.

COBOD is working towards turning their 3D printers into multifunctional construction robots challenging the current perception of what a 3D gantry system can do as well as challenging the current limited scope of the building mass to be robotized.

Customer testimonials



"After we got the printer, we printed our first storage building and we were very satisfied with the result and the printer that enabled it. COBOD's technology turned out to be exactly as promising as we had hoped."

Fredrik Wannius
CEO



"We have purchased 3 printers from COBOD, and we have been delighted by the printers supplied as well as by the investment we made. COBOD is a fantastic company and we're very pleased that we are the distribution partner of COBOD in certain parts of Europe and the US."

Dr. Fabian Meyer-Brötz
Head of 3D Construction Printing



"We chose COBOD as the supplier, as they were leading the development of providing large scale printers. Through working with the BOD2 printer, our students gain first-hand knowledge of additive technology and its potential for use and development by industry."

Malene Kirstine Holst
Head of Department



"This project is extremely innovative and challenging, with many brand new solutions to be developed. The project has progressed very well, and we are positively surprised by the fast increase in productivity achieved by COBOD. GE is used to being serviced well by its' suppliers, but we have nonetheless been really impressed with the COBOD team, their exceptional innovative solutions, skills, service level and dedication."

Matteo Bellucci
Advanced Manufacturing Leader



"The BOD2 printer has fully lived up to what COBOD promised it would, and it was more than instrumental in securing our success when we 3D printed our building."

Maarten Puls
Head of the Economy, Regional Policy and Europe



"We wanted to introduce the 3D construction printing technology in Africa to help execute projects much faster. Due to the success of the project, the interest from the market, and the high level of support and service from COBOD, we are considering ordering more printers."

Francois Perrot
Managing Director



International A/S

Skudehavnsvej 17a
2150 Nordhavn
Denmark

info@cobod.com

North America, Inc.

228 Park Avenue South, #300
New York, NY, 10003, USA
Phone: +1 (844) 384-4351

americas@cobod.com

Asia Pacific SDN BHD

B1-02-02, Level 2, Sunway Geo Ave. 1
Jalan Lagoon Selatan
47500, Subang Jaya, Selangor
Kuala Lumpur, Malaysia
Phone: +60 19348 2234

apac@cobod.com