



**MiCoB®**

Merging Art, Automation and  
Construction



Innovative Solutions for a Sustainable Future !!!

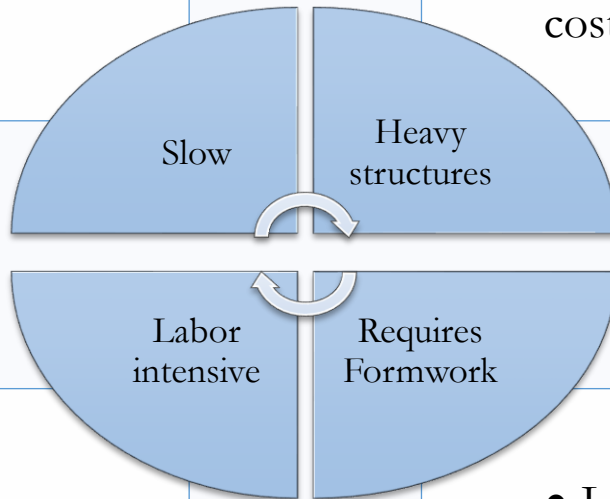
**Delivering Sustainability, Aesthetics and Speed using  
3D Concrete Printing technology**

# Challenges with Conventional Construction



- High finance cost

High material and transport cost



- High labor cost

- Limited design freedom

# Challenges in Defence



MiCoB®

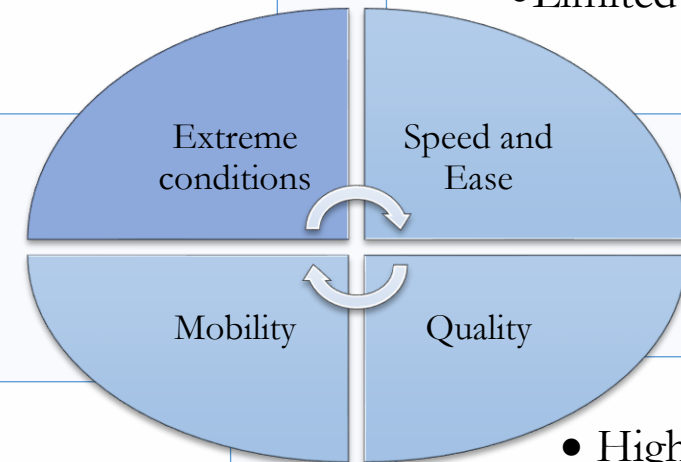
Only the best of friends and worst of enemies visit us!

-A popular Indian Army quote



- Climatic
- Terrain
- Reach

- Limited time
- Limited manpower



- Limited logistics
- Limited machinery

- High performance requirement
- Thermal comfort
- Living conditions

# How to Integrate MiCoB's 3D Concrete Printing Technology in your Building Construction

- Understanding 3D Concrete Printing
- Market Trends
- Use-cases
- Building configuration
- Joints/Connections
- Benefits
- Other applications
- Limitations

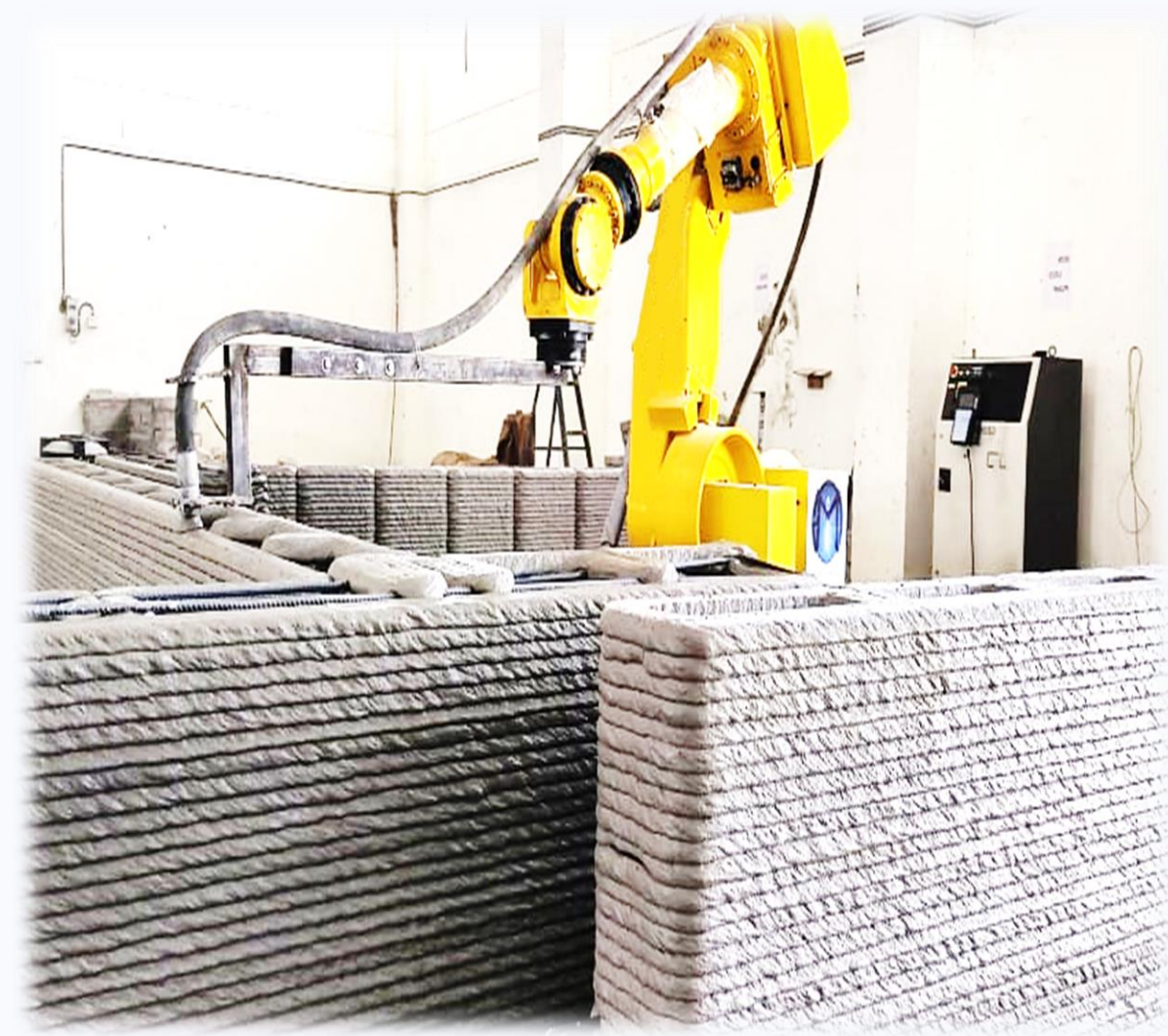


[MiCoB Project Video Link](#)



# Understanding 3D Concrete Printing

- 3D CAD model converted to Printed Structure layer-by-layer
- No need of formwork / shuttering
- Ease of creating complex, optimized, and modular structures
- Robust quality control from raw material input to finished 3D concrete structure
- Minimal construction waste
- Lower dependence on labor, higher productivity
- Reduced Total Cost of Ownership





MiCoB®

# Expertise and Strength

## 1 High- Performance 3D Printable Concrete mix

- ✓ 3-times lesser cost than competitors
- ✓ In-house production
- ✓ Wide spectrum of Printable Materials, e.g., Light-weight, High-strength up-to M60 grade

## 2 3D Printers

- ✓ 3-axis Gantry for large- scale structures
- ✓ 6-axis robot for complex and high precision structures
- ✓ Two large-scale and one mid-scale 3D concrete printer currently in use, one under maintenance

## 3 In-house proprietary software solution

- ✓ Advance 3D Concrete Printing software
- ✓ Features:
  - 3D Slicing
  - Multiple File Slicing
  - 3D Simulation
  - G- Code Generation
  - Estimation and Analysis

## 4 Tested and Approved

- ✓ Successful field trials against T-90 tank fires
- ✓ Successfully delivered 30 bunkers, 6 shelters and 3 buildings
- ✓ Empaneled Defence Contractor
- ✓ Technical specifications approved

National Startup Awards 2022 Winner





# Market Trends

## Global 3D Printing Construction Market to Garner \$750.8 Billion by 2031: AMR

Surge in use of 3D printers in the construction industry for making precise final products, developing prototype while lowering the production and materials cost and increase in adoption of green buildings and structure drive the growth of the global 3D printing construction market. The market across North America held the largest share in 2021, accounting for nearly two-fifths of the market.

July 14, 2022 07:22 ET | Source: Allied Market Research

### ICON lands \$207M Series B to construct more 3D-printed homes after seeing 400% YoY revenue growth

Mary Ann Azevedo @bayareawriter / 5:31 PM GMT+5:30 • August 24, 2021

Comment



Image Credits: ICON, Lake/FLATO Architects

Creating single-family homes for the homeless using 3D printing robotics. Developing construction systems to create infrastructure and habitats on the moon, and eventually Mars, with NASA. Delivering what is believed to be the largest 3D-printed structure in North America — a barracks for Texas Military Department.

3D Concrete Printing  
-  
A Fast Growing Market

### By 2030, 25% of Dubai buildings will be Constructed through 3D Printing

By MANUFACTUR3D • August 9, 2021 • 2 Mins read

396 ❤️ 0



Above: Dubai Skyline/Image Credit: ZQ Lee

In his capacity as Ruler of Dubai, Vice President and Prime Minister of the UAE His Highness Sheikh Mohammed bin Rashid Al Maktoum issued Decree No. (24) of 2021 regulating the use of 3D printing in the construction sector in the emirate. According to a statement from the media office, the legislation supports the emirate's strategic target to ensure that 25 per cent of its buildings are constructed using 3D printing technology by 2030.

## ThePrint

Ad closed by Google

- POLITICS ▾
- GOVERNANCE ▾
- ECONOMY ▾
- DEFENCE
- INDIA
- FEATURES ▾
- OPINION ▾
- EVENTS ▾
- VIDEO
- MORE ▾

Home > Defence > Army to set up 3D-printed permanent defences against China at LAC amid...

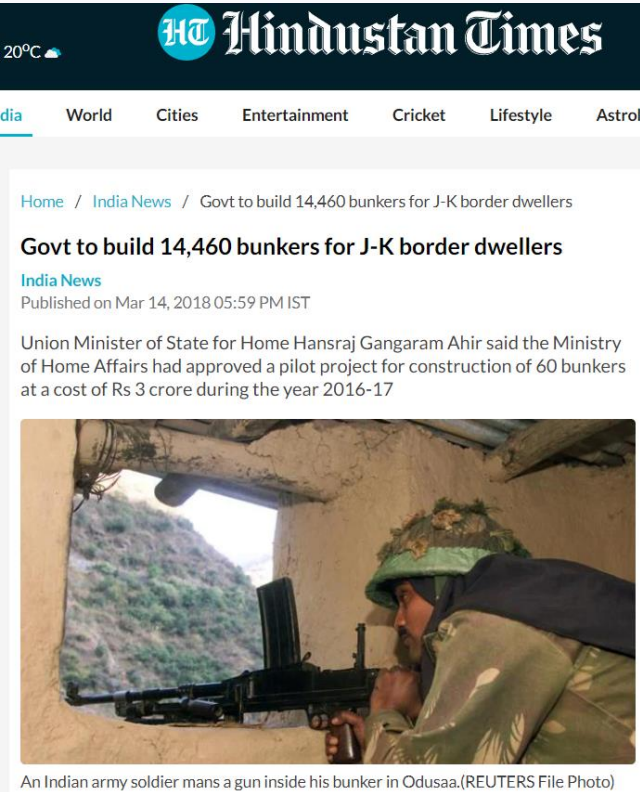
Defence

## Army to set up 3D-printed permanent defences against China at LAC amid infra push

Army has also pushed for massive road & tunnel construction in Ladakh as well as in Arunachal & Sikkim to strengthen its capability to quickly launch an operation and sustain forward troops.

SNEHESH ALEX PHILIP 15 November, 2022 06:56 pm IST


# A Paradigm Shift in the way our Army is Building Bunkers with MiCoB's Technology



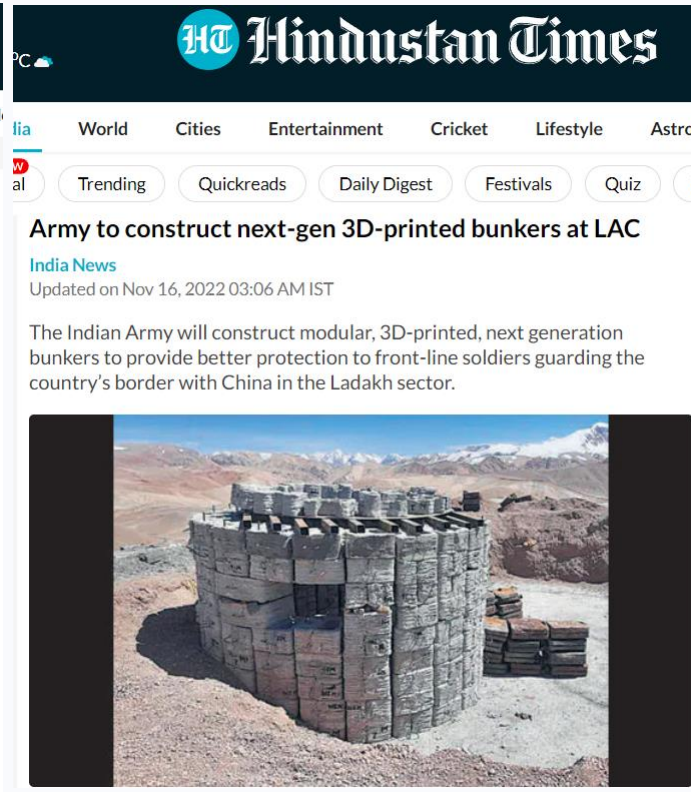
**Govt to build 14,460 bunkers for J-K border dwellers**

Published on Mar 14, 2018 05:59 PM IST

Union Minister of State for Home Hansraj Gangaram Ahir said the Ministry of Home Affairs had approved a pilot project for construction of 60 bunkers at a cost of Rs 3 crore during the year 2016-17




An Indian army soldier mans a gun inside his bunker in Odusaa.(REUTERS File Photo)



**Army to construct next-gen 3D-printed bunkers at LAC**

Updated on Nov 16, 2022 03:06 AM IST

The Indian Army will construct modular, 3D-printed, next generation bunkers to provide better protection to front-line soldiers guarding the country's border with China in the Ladakh sector.




3D-printed permanent defences have been constructed for first time by Indian Army's Corps of Engineers in desert sector. These defences were trial tested against a range of weapons from small arms to the main gun of T90 tank: Indian Army's Engineer-in-Chief Lt Gen Harpal Singh



6:53 PM · Nov 15, 2022 · Twitter Web App

345 Retweets 12 Quote Tweets 3,358 Likes

- ✓ Reduced Total Cost of Ownership
- ✓ Increased Human Productivity
- ✓ Reduced Material Consumption
- ✓ Reduced Logistics requirements
- ✓ Improved Durability
- ✓ Portable and Modular
- ✓ Impact and Blast Resistant

## Solved the Toughest Construction Problem of Building Critical Infrastructures at the Extreme Climatic and Geographical Conditions

- ✓ Extreme heat (>50 degree in desert dunes)
- ✓ Extreme cold (<(-)20 degree at 18,000+ feet altitude)
- ✓ At 5 times faster construction speed





MiCoB®

# Products and Use Cases

## Impact & Blast Resistant Bunker



- ✓ Tank & Rocket Launcher resistant
- ✓ Man-portable & Modular
- ✓ Easier & Faster disassembly and relocation
- ✓ Rapid construction in challenging terrain
- ✓ Price for bunkers:
  - ✓ Desert Sector ~ INR 6.5 Lakh
  - ✓ Hilly Terrain ~ INR 8 Lakh

## Hollow Wall Panels and Façade



- ✓ Reduced Dead and Seismic load
- ✓ Saving in steel and concrete for Foundation and Super-structure
- ✓ Enhanced insulation due to air-voids
- ✓ Reduced carbon footprint and enhanced energy-efficiency

## Office Building



- ✓ 3D Printed Runway Controller Hut
- ✓ First of its kind in India (Pune Air Force Station)
- ✓ Hybrid steel & 3D Concrete printed structure
- ✓ Construction in less than 30 days
- ✓ Quality compliant and cost-effective



# Products and Use Cases

## Residential Building



## Customized Concrete Furniture



## 3D Concrete Printer



## Marine Infrastructure





# Recent Building Use-cases



MiCoB®



© MiCoB Private Limited



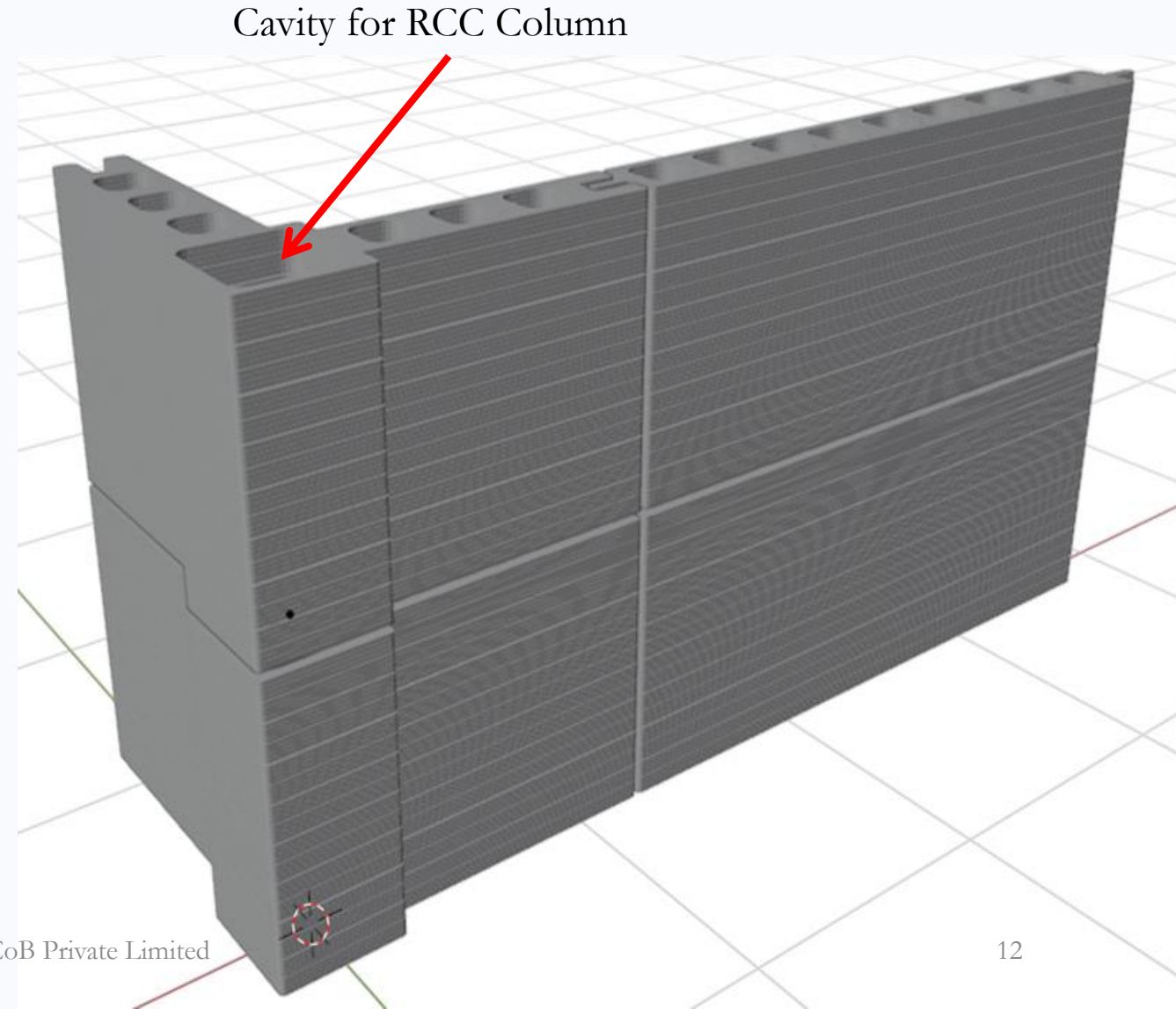
# Building configuration

- Structural system:
  - Foundation – Cast-in-situ RCC
  - Moment resisting system – RCC Frame / Structural Steel for columns and beams
  - Walls- Prefab 3D Printed Reinforced Concrete encasing the columns, and beams above the wall
  - Roof- Prefab / Cast-in-situ RCC
  
- Walls shall be of 3D printed concrete with hollow internal structure.
  - No need of shuttering for columns, cavity provided in the 3D printed wall itself
  - No need of shuttering for beams above the wall
  - Reduced dead and seismic load (1100kg/cubic meter compared to 1800kg/cubic meter for conventional masonry)

# Joints/Connections

- When the panels are manufactured in prefabricated mode, there will be two type of gaps created after erection of 3D printed concrete panels :

- Horizontal gaps
- Vertical gaps

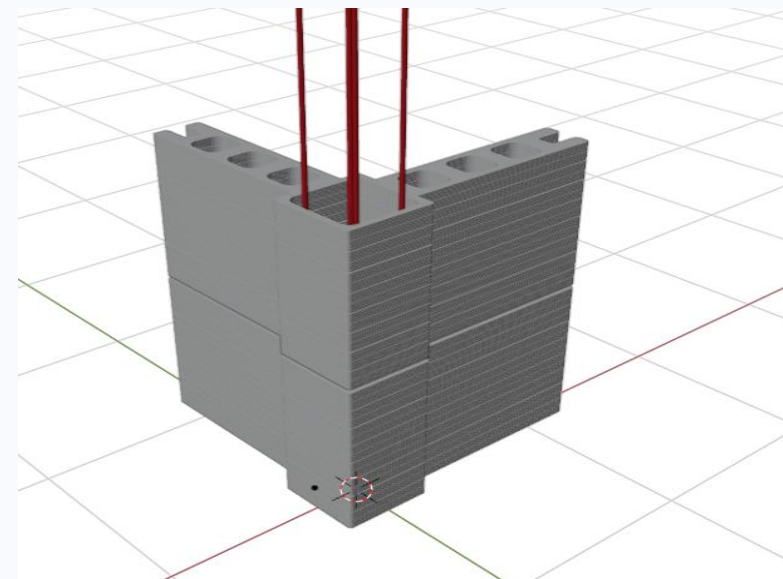
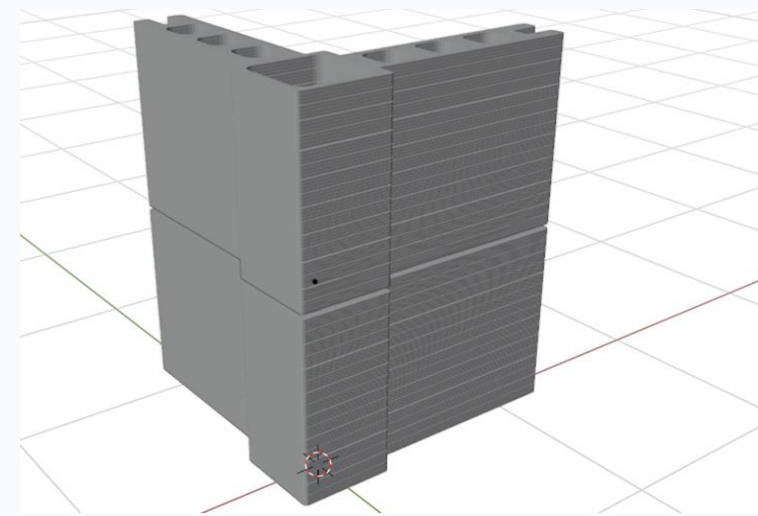




# Joints/Connections

## ■ Horizontal Gaps/Joints

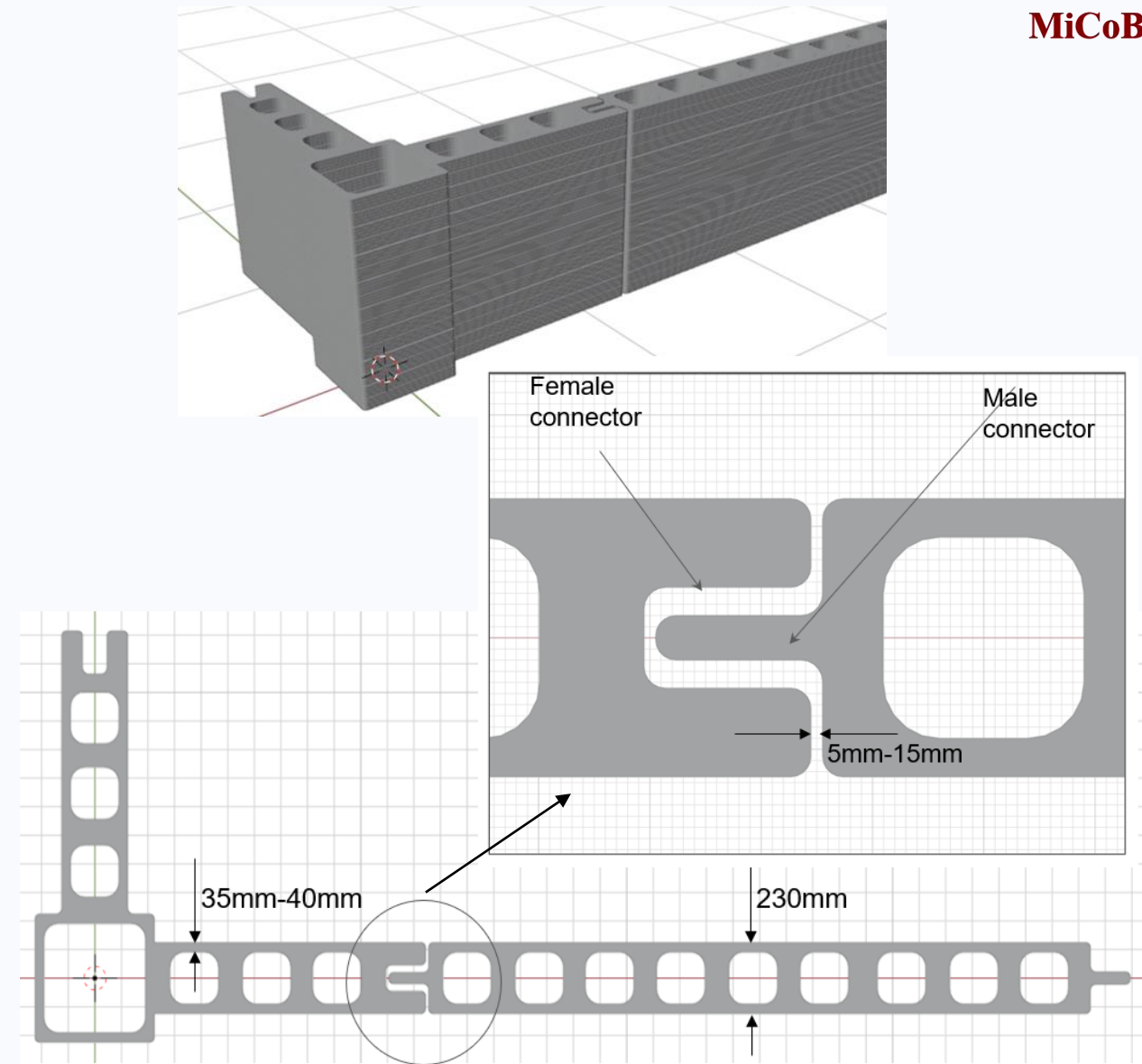
- These gaps are created when panels are put on top of each other. The gap thickness is very less (i.e. approximately 0.5mm to 2mm)
- This type of gap can be easily treated by placing very thin layer of concrete mortar/paste before erecting the upper panel on the panel just below. Moreover the cavity for the column when is filled with ready-mix concrete and is allowed to set, provides even better integrity and bonding between these panels. So this gap actually doesn't create any problems.



# Joints/Connections

## ■ Vertical Gaps/Joints

- These gaps are created while the panels are erected next to each other with male female type of interlocking. The gap thickness is of the order of 5mm to 15mm.
- There are two main concerns to be tackled while vertical gap treatment.
  - Structural integrity
  - Seepage prevention
- The structural integrity while joining two adjacent horizontal panels is created by providing a locking system with one panel having male part and the other panel with female part.





# Joints/Connections

- Seepage prevention is also a crucial part in gap treatment. Since vertical gap is very long and of the order of 10mm, it is very prone to seepage without proper treatment. Mainly four steps are performed for this
  - Backer rod installation
  - Applying primer
  - Caulking of sealant
  - Finishing with non-shrink grout applied with glass-fiber mesh



Backer rod installation



Applying primer



Caulking sealant



Non-shrink grout with  
glass-fiber mesh

# Benefits

- Faster construction
- Better thermal insulation due to air voids in the wall
- No need of external plaster, direct painting can be done or the structure can be left exposed as well for a modern architecture look.
- Aesthetically superior compared to conventional rectilinear structure
- Less dependency on labour
- Superior quality due to controlled environment 3D printing process, and no adulteration in the manufacturing process.
- Minimal wastage at site
- No efflorescence which generally happens in the brickwork/masonry.
- Reduced maintenance, which is generally required to repair the chip off in plaster work.
- Better sound insulation due to air voids in the walls.
- Lower HVAC cost/ higher building energy efficiency due to air voids.
- Higher building life due to extra cover to structural members



# Legacy – Our 3D Printed Concrete Furniture Range



Durable

Affordable

Premium Quality





# Potential Other Applications

- Embankments
- Boundary Walls
- Underground Structures
- Culverts, Cable Trenches and Drains
- Material Storage Units
- Bridges
- Marine Infrastructure



# Mission



## Man-Machine Integration

Increase Human Productivity by Upto 10x



## Reduce Cost and Time

Upto 30% and 70% Respectively



## Reduce Carbon Footprint

Upto 50% Less Material Consumption,  
and 30% more building energy efficiency

# Vision

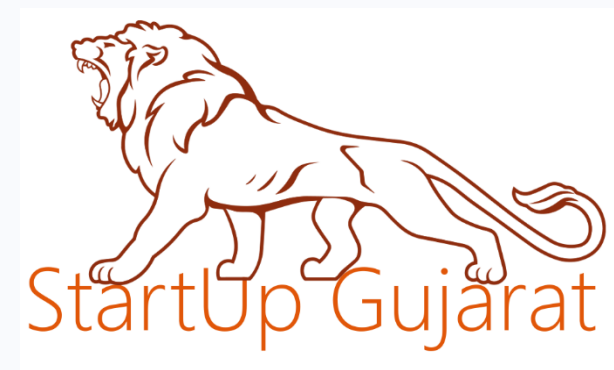
- ✓ Transform infrastructure with 3D printed bridges, culverts, drains, trenches, boundary walls, embankments, and marine applications
- ✓ Disrupt High-end Individual Housing with Tech-enabled, High-transparency platform for 3D printed Green buildings
- ✓ Replace high carbon footprint and low efficiency walls and façade with light-weight, high-performance 3D Printed panels



# Acknowledgment



MiCoB®







MiCoB®



**MiCoB®**

Let's *PRINT* the Future

Thank you

**You Think, We Print**

**Contact us:**

Contact no: 8980701991

Email: [shashank@micob.in](mailto:shashank@micob.in)

Website: [www.micob.in](http://www.micob.in)

**Visit us:**

Warehouse 3, Gate 4, ICD Khodiyar,  
CONCOR, Gandhinagar, 382421

**Social media:**

<https://www.facebook.com/MicobPvtLtd/>

[https://www.instagram.com/micob\\_india/](https://www.instagram.com/micob_india/)

[https://twitter.com/micob\\_india](https://twitter.com/micob_india)

<https://www.linkedin.com/company/micob-pvt-ltd>



**MiCoB<sup>®</sup>**

# **Annexure**





# Project Videos

[3-Storey Staff Accommodation at Vizag](#)

[2-Storey NCO Accommodation at Ahmedabad](#)

[Air Traffic Control Hut at Pune Airport](#)

[ORL Shelter at Ahmedabad](#)



MiCoB®

# Indian Army's Testimony



ANI

@ANI

Official

3D-printed permanent defences have been constructed for first time by Indian Army's Corps of Engineers in desert sector. These defences were trial tested against a range of weapons from small arms to the main gun of T90 tank: Indian Army's Engineer-in-Chief Lt Gen Harpal Singh



6:53 PM · Nov 15, 2022 · Twitter Web App

345 Retweets 12 Quote Tweets 3,358 Likes



Ministry of Defence



## INDIAN ARMY INAUGURATES FIRST EVER TWO STOREY 3-D PRINTED DWELLING UNIT AT AHMEDABAD

Posted On: 29 DEC 2022 11:39AM by PIB Delhi

The Indian Army inaugurated its first 3-D Printed House Dwelling Unit (with Ground plus One configuration) for soldiers at Ahmedabad Cantt on 28 December 2022. The dwelling unit has been constructed by the Military Engineering Services (MES) in collaboration with MiCoB Pvt Ltd incorporating the latest 3D Rapid Construction Technology.

Construction work of the dwelling unit measuring 71 sqm with garage space was completed in just 12 weeks by utilising the 3D printed foundation, walls and slabs. The disaster-resilient structures comply with Zone-3 earthquake specifications and green building norms. The 3-D printed houses are symbolic of the modern-day rapid construction efforts to cater for growing accommodation requirements of the Armed Forces personnel. This structure also stands testament to the commitment of Indian Army in fostering the 'Atmanirbhar Bharat Abhiyan'.

The technique utilises a concrete 3D printer that accepts a computerised three-dimensional design and fabricates a 3-D structure in a layer-by-layer manner by extruding a specialised type of concrete specifically designed for the purpose.

Ahmedabad based Golden Katar Division of Indian Army has been instrumental in pursuing the project with manifold applications even in operations. Indian Army units have already dovetailed 3D printing technology in construction of pre-casted permanent defences and overhead protection meant for operations. These structures are currently being validated over a period of one year and can be seen being incorporated in all terrains, the recent being in the UT of Ladakh.







MiCoB®

# Indian Army's Testimony



India World Cities Entertainment Cricket Lifestyle Astrology

Trending Quickreads Daily Digest Festivals Quiz

## Army to construct next-gen 3D-printed bunkers at LAC

India News

Updated on Nov 16, 2022 03:06 AM IST

The Indian Army will construct modular, 3D-printed, next generation bunkers to provide better protection to front-line soldiers guarding the country's border with China in the Ladakh sector.



India World Cities Entertainment Cricket Lifestyle Astrology

Home / India News / Govt to build 14,460 bunkers for J-K border dwellers

## Govt to build 14,460 bunkers for J-K border dwellers

India News

Published on Mar 14, 2018 05:59 PM IST

Union Minister of State for Home Hansraj Gangaram Ahir said the Ministry of Home Affairs had approved a pilot project for construction of 60 bunkers at a cost of Rs 3 crore during the year 2016-17



An Indian army soldier mans a gun inside his bunker in Odusaa.(REUTERS File Photo)

### Web Links

[The Economic Times](#)

[ThePrint](#)

[Hindustan Times](#)

[Indian Express](#)

[First Post](#)



Vantage India World Sports Tech/Auto Opinion Explainers Entertainment Cricket

INDIA

## Indian Army's 3D printed defence bunkers on Western Front: What are they all about

The newly-built bunkers are flexible and can be set up within 36-48 hours, and they can also be relocated from one place to another. Since these bunkers can withstand blasts as well as tank fire in a war-situation, they will be set up at higher altitudes and forward locations by the Indian Army

Sohini Sarkar | November 17, 2022 19:54:28 IST







MiCoB®

# Indian Army's Testimony

ThePrint

POLITICS GOVERNANCE ECONOMY DEFENCE INDIA FEATURES OPINION EVENTS VIDEO MORE

Home - ANI Press Releases - MiCoB delivers 3D Concrete Printed Runway Controller Hut for the Pune Air...

## MiCoB delivers 3D Concrete Printed Runway Controller Hut for the Pune Air Force Station

ANI PR | 10 October, 2022 12:18 pm IST

Facebook Twitter LinkedIn Email WhatsApp Like 0



... challenge to his power  
Aarti Bhat - 21 November 2022


NDTV.COM ASIAN NEWS INTERNATIONAL



## Pune Air Base Unveils 3D-Printed Runway Controller Hut

Using 3D printing technology, the Military Engineer Services (MES) has constructed a first-of-its-kind Runway Controller Hut at the Pune Air Force station in just 30 days, officials said Thursday. The novel construction includes 3D printed concrete foundation and wall panels, besides the ground-floor roof using precast technology.

Read the article on ndtv.com >

 **Indian Institute of Technology Gandhinagar**  
34,829 followers  
4d •

**IITGN R&D Horizon 16:** "MiCoB is a special success story of a PhD work carried out at IIT Gandhinagar that transformed into a commercial product adopted by the Indian Army for strategically important purposes. Their product's distri ...see more



Innovation for Defence Excellence Award by the Ministry of Defence



with their gantry-based large-scale 3D concrete printing



© MiCoB Private Limited

rd Mumbai Delhi Bengaluru Hyderabad Kolkata Chennai Agra Agartala Ajmer  
hmedabad



- Cost-wise, the basic printing facility costs Rs 1.5 crore upwards in the US and some European nations, whereas the team claims to be setting it up at Rs 50 lakh
- The price of concrete mortar used for 3D printing starts at around Rs 25,000 per ton, which is reduced to Rs 5,000 by the team to bring it closer to cost of normal concrete structures
- The team includes three PhD students of IIT-Gn from various disciplines
- The team has filed three Indian patents for additive manufacturing using self-compacting concrete, 3D-printed wall panels and its construction method, and an apparatus and method of 3D printing developed by them





# Indian Army's Testimony

**ADGPI - Indian Army** ✓  
4d · ⚙️

General MM Naravane #COAS reviewed the ongoing preparations for #DefExpo2022 and witnessed the technology adaptation of Army's first 3D Printed Living Shelter as part of #AtmaNirbharBharat endeavours, during the visit to #Gandhinagar #Gujarat.

#IndianArmy  
#InStrideWithTheFuture



Feature	3D Printed Living Accommodation	Conventional PUF Living Accommodation
Site Construction	30 Section days (Desert terrain) 45 Section days (Hilly terrain)	45-60 Section days (Desert terrain) 60-90 Section days (Hilly terrain)
Structural Life	Equivalent to RCC (> 50 years)	5-10 years
Thermal comfort	Good, due to macroscopic air voids	Moderate
Protection against small arms	Yes	No

# MiCoB's Leadership Team



**Shashank Shekhar**  
**CEO & Co-Founder**

Ph.D. (Thesis submitted) in 3D  
Concrete Printing at IIT  
Gandhinagar

B.Tech. in Civil Engineering from  
IIT Roorkee

Experience of Construction  
Industry at Jindal Steel



**Rishabh Mathur**  
**CTO & Co-Founder**

M Tech in Mechanical  
Engineering from IIT  
Gandhinagar

Gold Medalist in Aeronautical  
Engineering in B.Tech. from  
Rajasthan Technical University

Specialization in Robotics and  
Control



**Dr. Ankita Sinha**  
**CMO/COO & Co-  
Founder**

Ph.D. in Mechanical  
Engineering from IIT  
Gandhinagar

B.E. Hons. in Mechanical  
Engineering from RGTU,  
Bhopal

HR, Public relations,  
Accounting, Compliances,  
Marketing and sales  
strategies



**Dr. Vinod Chopra (Joining soon)**  
**CFO**

Ph.D. in Management from  
International University of South Korea.

Experienced Managing Director with a  
demonstrated history of working in the  
management consulting industry.

Negotiation, Business Planning,  
Renewable Energy Systems, Customer  
Relationship Management



# We are Standing on the Shoulders of Giants: MiCoB's Mentors



**Mr. Kamalesh Dwivedi**  
**President**  
**3Lines VC, USA**

Ex-CIO of several global corporations in their transformative phases in the US and Japan

Alumni of Harvard Business School, Carleton University and IIT Kanpur



**Mr. Parimal Karani**  
**Founder**  
**ANGMP, UAE**

Leading real estate developer in Dubai

Director at Kensville Golf and Living

Alumni of IIT Bombay



**Mr. R. A. Venkitachalam**  
**Advisor**  
**IIT Gandhinagar**

Former VP, Underwriters Laboratories

Held top level positions with leading organizations like UL/ Asian Paints/ Thermax / Vodafone (from 1979 -2003)

Alumni of IIT Madras