# hyperion

## LEADING THE TRANSITION TO SUSTAINABLE AUTOMATED CONSTRUCTION

Created for the builders of tomorrow, our solution will save, upcycle and optimise today



Helsinki, Finland - April 2023

Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient,





We are working with clients and partners, who lead global industries



We have partnered with some of the best investors in Europe



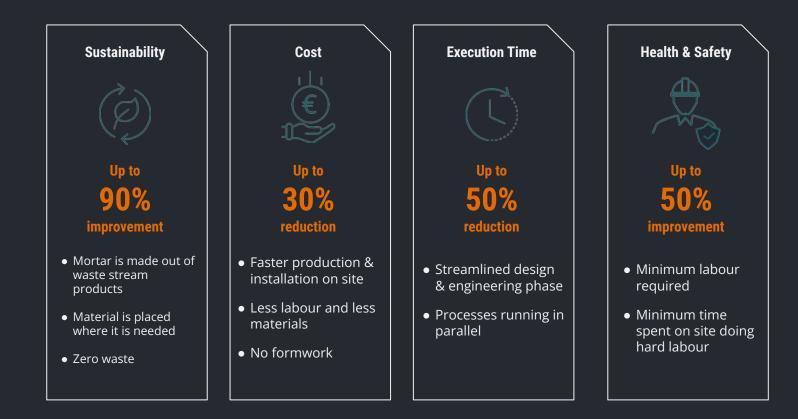
Concrete: massive source of eCO2 The most widely used man-made material on earth generates 8% of global CO2 emissions every year, an equivalent of 2.8 billion tons of CO2

**Construction is not sustainable** The way structures are built hasn't changed in decades and construction is the least automated industry. By 2023, 40% of global skilled labour will retire. Our solution is Optimized and Sustainable infrastructure with Large-scale 3D printing and low-carbon concrete.

15

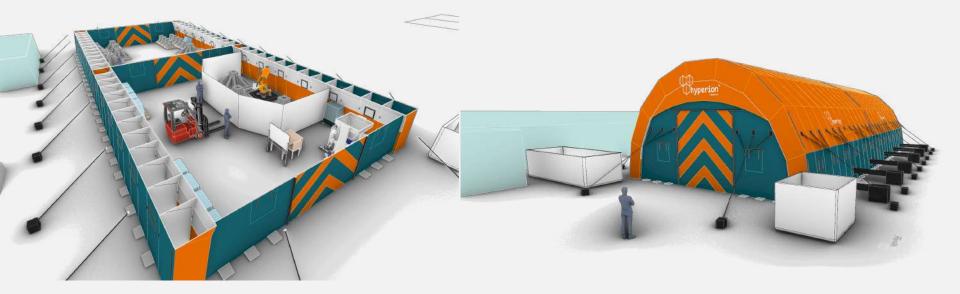
**75% less materials**, is produced **3X faster** and presents **50% CO2 reduction** compared to traditional foundations.

#### **KEY GENERAL BENEFITS**



Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message

#### **HYPERION 3D PRINTING MICRO-FACTORIES**





#### **HYPERION 3D PRINTING MICRO-FACTORIES**





Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original messane

#### **HYPERION 3D PRINTING MICRO-FACTORIES**





#### **HYPERION CONSTRUCTION APPLICATIONS**



Water tanks



#### **Trenches and Nodes**

Artificial reefs and Marine Infrastructure

Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original

#### **HYPERION CONSTRUCTION APPLICATIONS**



Staircases

Inspection chambers and manholes

#### Walls and building components

**Urban furniture** 



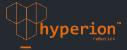
Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message

#### **3D PRINTED TEXTURES**



3D printing allows a variety of textures and forms that would be almost impossible to replicate with traditional methods of construction. Above are a few explorations that Hyperion has performed in the past.

hyperion



## PAD FOUNDATION USE-CASE



Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the origin

#### **OPTIMIZED PAD FOUNDATION**



#### By placing material were it is most

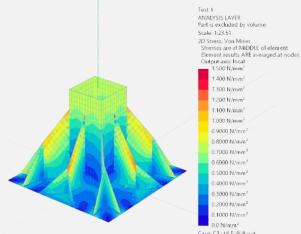
**needed**, Hyperion can create robust and efficient structures in collaboration with our client's engineering team.

In this application, the result is a thin slab stiffened by a series of ribs branching out from the main trunk of the foundation.

Compared to traditional mass concrete foundations, this foundation has 2 main material benefits:

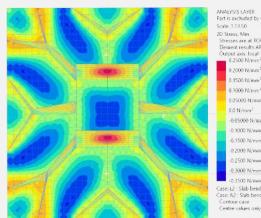
- It <u>utilises only 25%</u> of the typical amount of material
- It <u>saves up to 80%</u> of excavated material removal from site

### **ENGINEERING DESIGN**





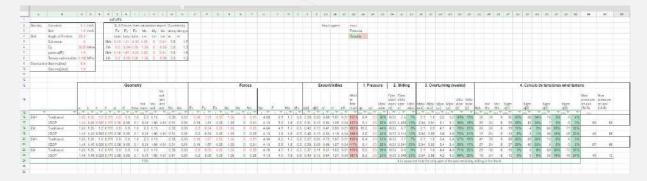




ANALYSIS LAYER Part is excluded by volume Scale: 1:13.50 2D Stress, Min Stresses are at TOP of element Element results ARE averaged at nodes Output axis: local: 0.2500 N/mm<sup>2</sup> 0.2000 N/mm2 0.1500 N/mm<sup>2</sup> 0.1000-N/mm<sup>2</sup> 0.05000 N/mm<sup>2</sup> 0.0 N/mm<sup>2</sup> -0.05000 N/mm -0.1000 N/mm -0.1500 N/mm2 -0.2000 N/mm<sup>2</sup> -0.2500 N/mm<sup>2</sup> -0.3000 N/mm<sup>2</sup> 0.3500 N/mm Case: L2 : Slab bending Case: A2 : Slab bending Contour case

The structural design was based on the client's load requirements.

A spreadsheet calculator was created to determine the overall dimensions of the pad foundation and a series of FEM (Finite Element Modeling) models was created for local stress checks



hyperion

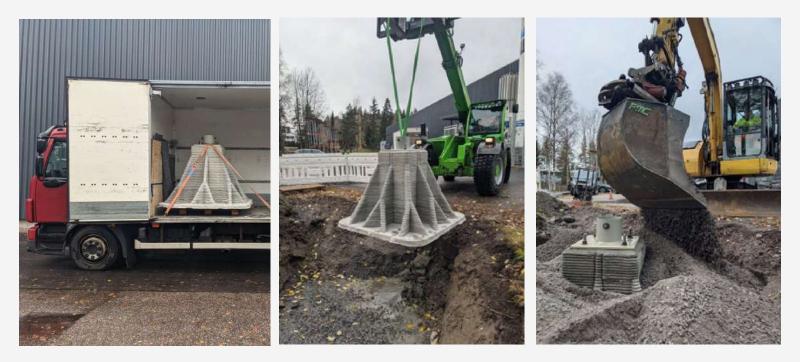
Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original

#### **3D PRINTING PRODUCTION**



The printing was achieved in 1h15 min for the 1.5 ton optimized foundation. Steel inserts provided by Peikko were embedded within the printed concrete and steel rods were then grouted in the pockets created by the printer. It requires **2 people to operate our machinery**. One holding the robot controller, the other one checking material feeding.

#### **DELIVERY TO SITE AND INSTALLATION**



The foundation was transported in a truck and lifted into the hole excavated beforehand. A digger and hand-held compactor were used to backfill the excavation with the original soil material similar to what is traditionally done on site.

#### **CODE COMPLIANCE AND REGULATIONS**

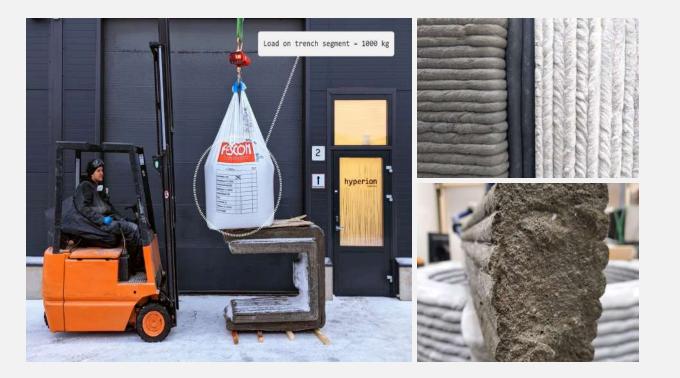


2 tests were performed to assess the resistance of the foundation. The first, horizontal pull, was to test the overturning resistance of the foundation. The second, was a direct uplift.

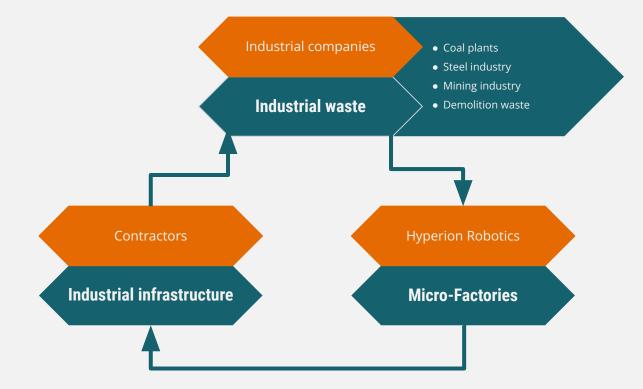
Both tests resulted in a **factor of safety of 3x** which correlated with the calculations

#### **CODE COMPLIANCE AND REGULATIONS**

We follow a rigorous testing regime and a process called "DESIGN BY TESTING"



### **CIRCULAR VALUE CHAIN**



#### **RANGE OF MATERIALS**



- Up to 80 MPa
- Cement based and fully recycled materials
- Ingredients upcycled from industrial waste streams
- The **lowest CO2** 3D-printable materials on the market

Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original

### **CASE STUDY: CEMENT FREE WATER TANK**

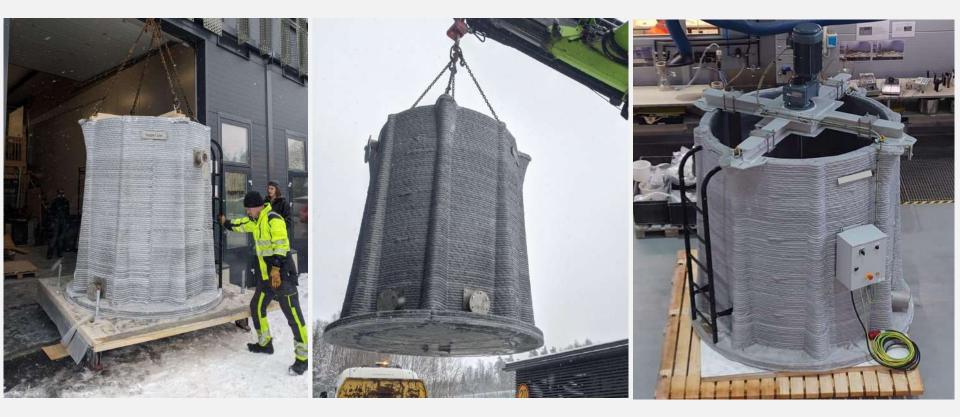
#### **Key Benefits:**

- Eco-friendly approach to reuse directly available material from the mining process.
- Speed of execution with automated approach
- Large scale elements with all features built directly into the object









#### 97% RECYCLED

#### **ZERO CEMENT**

#### 90% LESS CO2

## Hyperion Carbon Project <> MIKSEI MIKKELI

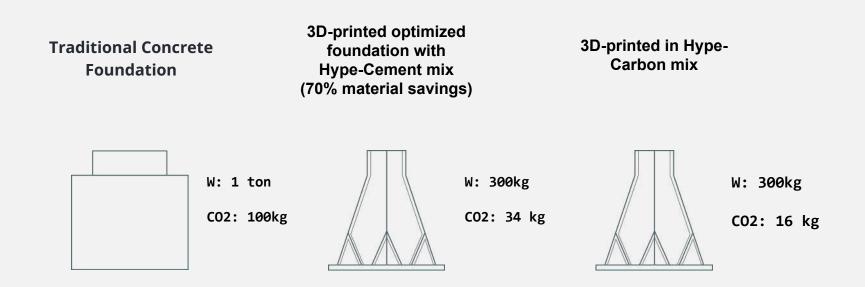
#### LOW-CARBON 3D PRINTING CONCRETE WITH BIOCHAR



Confidentiality Notice: This document is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original messane

## Hyperion Carbon Project <> MIKSEI MIKKELT

The following carbon savings calculator shows the impact of combining Hyperion's optimized foundations.

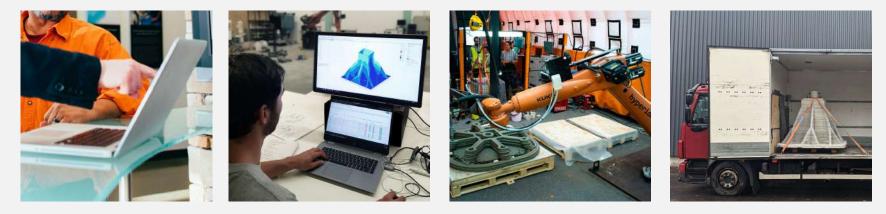


#### WITH FURTHER DEVELOPMENT, WE CAN ACHIEVE CARBON NEGATIVE STRUCTURES!!

hyperion

### **CUSTOM PRODUCTS & REQUIREMENTS: PROCESS**

If you haven't found what you are looking for in our catalogue, please contact us to describe your needs and specifications. Our team of engineers will design for you any solution for your custom elements.



1. Scope definition and planning

2. Design and engineering

3. Onsite and offsite production

4. Delivery



## MICRO-FACTORY VIDEO hyperion 🖗 peikko



Fernando De los Rios - CEO

fd@hyperionrobotics.com

www.hyperionrobotics.com

# LET'S 3D PRINT A BETTER FUTURE TOGETHER

