75% MATERIAL SAVINGS IN FOUNDATIONS BY USING 3D PRINTING TECHNOLOGY

– ADDITIONAL BUSINESS LINE FOR PRECASTERS?
ABOUT PEIKKO GROUP

PEIKKO’S WORLD

We serve our customers locally with customer engineering as well as flexible, fast deliveries.

Headquarters
in Lahti, Finland

Certified manufacturing in
12 countries

Sales teams in
33 countries

Globally over
2,000 employees

Turnover 2022
314 million
Concrete generates over 2.8 billion tons of CO₂ every year

“The most widely used man-made material on earth generates

8% of global CO₂ emissions/year¹”

¹ World Economic Forum: Link
Starting question – do we need a new structure?

Could we use part or a whole existing structure?

Could we transfer frame components from an existing structure?
How could we optimize the structure to have less materials, with clever design & clever components?

Case HOLLOWCORE
How could we optimize the structure to have less materials, with clever design & clever components?

Case DELTABEAM®
How could we optimize the structure to have less materials, with clever design & clever components?

Case Wind Turbine Foundations
How could we optimize the structure to have less materials, with clever design & clever components?

Case PSB® Punching Shear
Ingredients of brightest solutions?

- Innovativeness of structural design
- Unconventional thinking of materials
- Unconventional thinking of manufacturing technology
- Off-site manufacturing
ABOUT HYPERION ROBOTICS

Finnish technology company

25 team members, 14 different nationalities

Experts in engineering, construction, 3D printing, materials science and business.
OUR NETWORK

OUR CLIENTS AND COLLABORATORS

peikko

Tarmac

IBERDROLA

Metso:Outotec

TECHINT

Engineering & Construction

KUKA

Yorkshire Water

Bentley

Fraunhofer
LOW-CARBON AND EFFICIENT INFRASTRUCTURE ELEMENTS
WE ARE DECARBONIZING CONSTRUCTION

Hyperion is on a mission to help our clients reach their ambitious net zero goals. At the core of what we do, we promote sustainability and circularity in all of our products and services.

- **Up to 75%** Less material
  - By placing material where it is most needed, Hyperion is able to save up to 75% material whilst providing the same resistance. Steel reinforcement is equally reduced.

- **3X** Faster to deliver
  - By integrating design and manufacturing with our automated process and eliminating the need for molds we produce structures much faster, reducing lead-times by more than 50%, offering a faster and competitive solution.

- **Up to 90%** Less CO2
  - By combining design optimization, upcycling of industrial waste materials and logistics optimization we can follow a highly sustainable and circular construction process.
HYPERION PRODUCTION FACILITY AND MICRO-FACTORIES
OPTIMIZED PAD FOUNDATION
DESIGN AND ENGINEERING

Test 1
ANALYSIS LAYER
Part is excluded by volume
Scale: 1/2.51
2D Stress, Vice Mises
Stresses are at MIDDLE of element
Results results ARE averaged at nodes
Output axis: local
1.500 N/mm²
1.300 N/mm²
1.200 N/mm²
1.099 N/mm²
9.9000 N/mm²
8.9000 N/mm²
7.9000 N/mm²
6.9000 N/mm²
6.0000 N/mm²
5.0000 N/mm²
4.0000 N/mm²
3.0000 N/mm²
2.0000 N/mm²
1.0000 N/mm²
0.0000 N/mm²
ANALYSIS LAYER
Part is excluded by volume
Scale: 1.50
2D Stress, Mises
Stresses are at TOP of element
Results results ARE averaged at nodes
Output axis: local
0.5000 N/mm²
0.3000 N/mm²
0.1000 N/mm²
-0.1000 N/mm²
-0.3000 N/mm²
-0.5000 N/mm²
-0.0000 N/mm²
-0.0500 N/mm²
-0.1000 N/mm²
-0.1500 N/mm²
-0.2000 N/mm²
-0.2500 N/mm²
-0.3000 N/mm²
-0.3500 N/mm²
-0.4000 N/mm²
Case 12: L/S: Debonding
Case 13: L/S: Debonding
Case 14: H/S: Debonding
Centre values only
Centre values only
3D PRINTING MANUFACTURING
DELIVERY TO SITE AND INSTALLATION
CODE COMPLIANCE IS IN OUR DNA
CHARACTERIZATION OF HYPERION 3D MORTAR

<table>
<thead>
<tr>
<th></th>
<th>Hyperion 3D mortar</th>
<th>Conventional concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength (x)</td>
<td>49.9 MPa</td>
<td>40 to 45 MPa for C32/40 and C35/45 classes</td>
</tr>
<tr>
<td>Compressive strength (y)</td>
<td>53.4 MPa</td>
<td></td>
</tr>
<tr>
<td>Compressive strength (z)</td>
<td>51.53 MPa</td>
<td></td>
</tr>
<tr>
<td>Bending Tensile strength (y)</td>
<td>7.05 MPa</td>
<td>3 to 3.2 MPa for C32/40 and C35/45 classes</td>
</tr>
<tr>
<td>Bending Tensile strength (z)</td>
<td>5.64 MPa</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>2079 kg/m³</td>
<td>2400 kg/m³</td>
</tr>
<tr>
<td>Chloride penetration coefficient</td>
<td>$1.83 \times 10^{-12}$ m²/s</td>
<td>Based on fib Bulletin 34, this concrete is considered as a high quality material in subject to chloride exposure</td>
</tr>
<tr>
<td>Freeze Thaw</td>
<td>$M_{32} = 0.26$ kg/m²</td>
<td>XF3 with design life of 50 years</td>
</tr>
</tbody>
</table>
factor of safety of 3x
WE BUILD REINFORCED CONCRETE STRUCTURES

All our structure incorporate standard B500 grade reinforcement following the guidance of EN 1992-1.
FURTHER DEVELOPMENTS
FULL-SCALE TESTING
DEPLOYMENT OF MICRO-FACTORY
DEPLOYMENT OF MICRO-FACTORY
DEPLOYMENT OF MICRO-FACTORY
HYPERION CONSTRUCTION APPLICATIONS

Foundations are a great application due to the amount of materials we can save but we can also produce many more products!
HYPERION CONSTRUCTION APPLICATIONS

And many more.

Staircases

Inspection chambers

Retaining walls and noise barriers

Footbridges and beams
LOW-CARBON MATERIAL POSSIBILITIES

Hyperion’s material catalogue of sustainable construction materials includes both cementitious and alkali activated concrete. All materials are tested using 3rd party accredited laboratory Eurofins.fi and material certificates can be provided upon request.

- **Hyper-Cem** (105 kg eCO2/ton)
  - Cement-based mix

- **Hyper-Geo** (15 kg eCO2/ton)
  - Cement-less alkali circular, activated mix

- **Hyper-Carbon** (28 kg eCO2/ton)
  - Carbon based mix
CEMENT-FREE WATER TANK
1. Scope definition and planning
2. Design and engineering
3. Onsite and offsite production
4. Delivery
WATER INFRASTRUCTURE
LET’S 3D PRINT A BETTER FUTURE TOGETHER

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