

Fibre reinforced concrete 3D printing

2nd REFRESH Stakeholder Workshop

Rubén Castaño Álvarez



13th May 2026



3D Printing in REFRESH Project

Objectives

1. **Design of a mix suited for 3D printing and its requirements** based on related cement-based experience, considering the process and application requirements.
2. **Development of the 3D printing mix incorporating different fibre dosages** to try to improve the mechanical properties of the material, such as ductility and flexural strength, while satisfying the fresh state requirements of the printing process.
3. **Preliminary testing of mixes including fibres both in the green and hardened state** to assess the suitability of the fibre dosage and fibre type tested.
4. **3D Print scale down wind turbine towers with the developed material for testing** and validating the material, process and design.

3D Printing in REFRESH Project

3D Printing material design requirements

- **Flowability** – To feed correctly the pumping system
- **Extrudability** – To go through the nozzle
- **Buildability** – To withstand the weight of the layers on top
- **Hardened state strength** – To withstand the stresses during transport, installation and service



3D Printing in REFRESH Project

Fibre types and dosages

Fibre type

FIBRE 1



FIBRE 3



FIBRE 2



FIBRE 4



Fibre dosage

2%



5%



10%



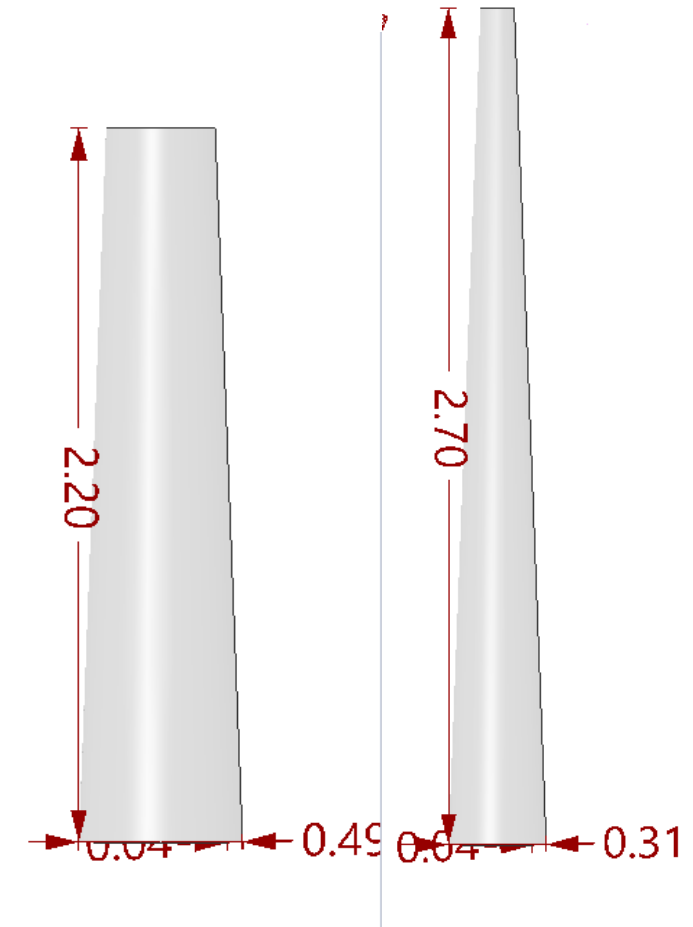
3D Printing in REFRESH Project

Tower design, analysis, printing and testing

- **Design** a printable scaled down version of a wind turbine tower

LIMITATIONS

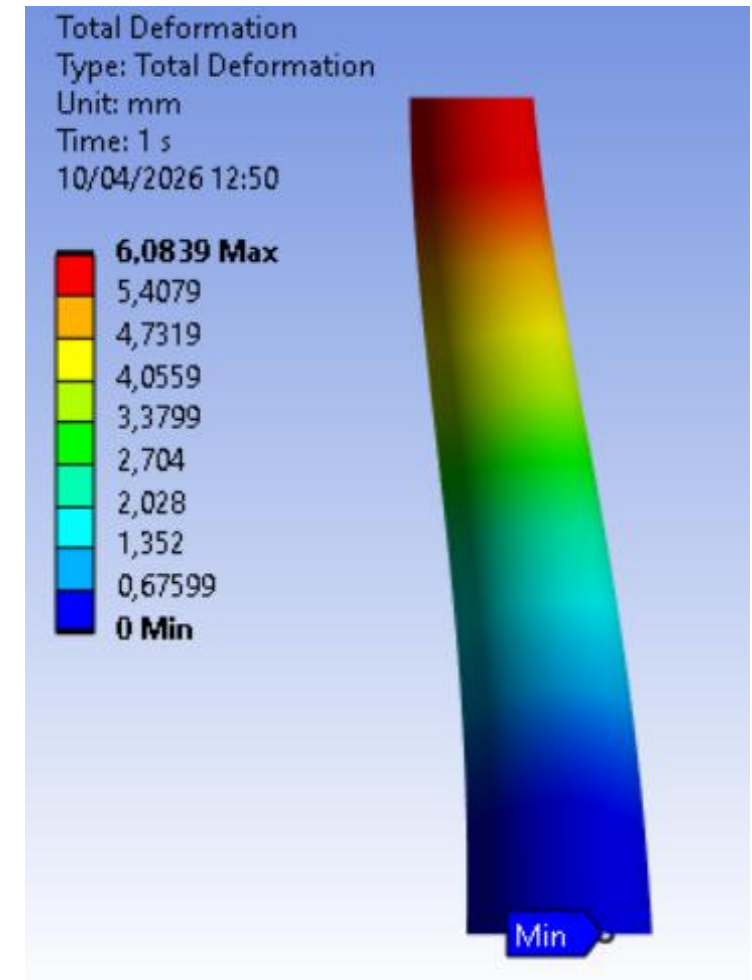
- Height of the ceiling in Laboratory (2,90 m)
- Size of nozzle (Ø20 mm)
- Minimum of two filaments for layer (wall thickness of 40 mm)
- Loading capacity for testing (Max ~150 KN on cyclic loading)



3D Printing in REFRESH Project

Tower design, analysis, printing and testing

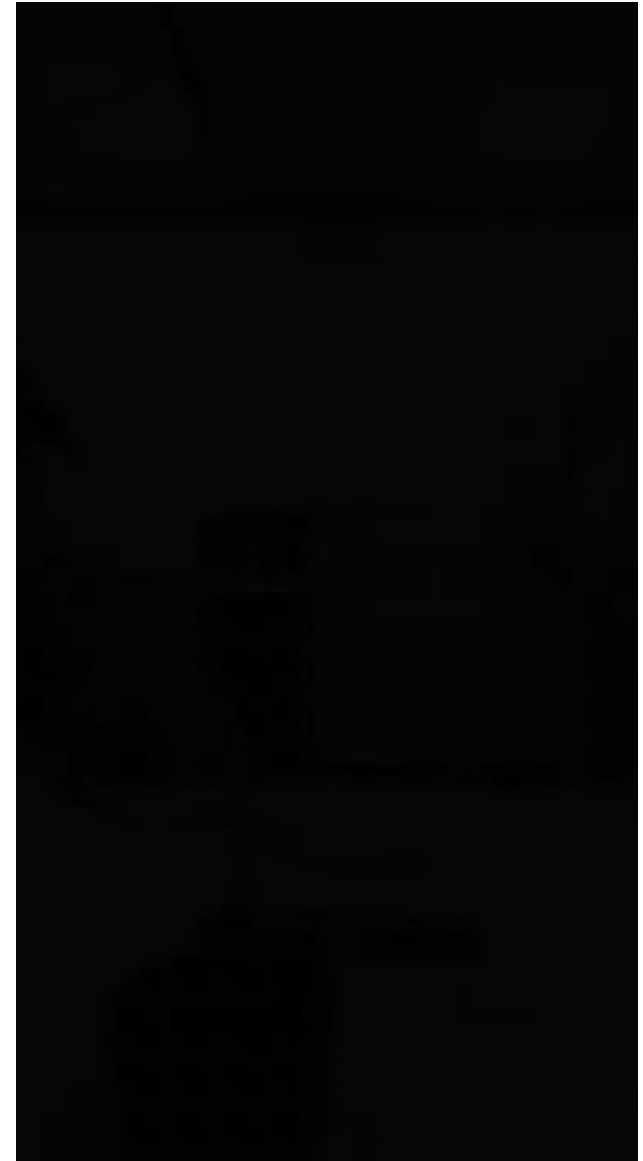
- **Design** a printable scaled down version of a wind turbine tower
- **Analyse** design performance by FEM simulations



3D Printing in REFRESH Project

Tower design, analysis, printing and testing

- **Design** a printable scaled down version of a wind turbine tower
- **Analyse** its performance by FEM simulations
- **Print** the scaled down towers



3D Printing in REFRESH Project

Tower design, analysis, printing and testing

- **Design** a printable scaled down version of a wind turbine tower
- **Analyse** its performance by FEM simulations
- **Print** the towers
- **Test** the towers to validate the material and the design

BENEFITS:

- Integration of recycled materials
- Optimized material design
- Enhanced material performance
- Scalability validation





Rubén Castaño Álvarez

tecnalia

MEMBER OF BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

ruben.castano@tecnalia.com

From End-of-Life Blades to Circular Products – Technologies, Prototypes and Market Pathways

13th May 2026