

PROJECT: ECOLOGICAL AND INNOVATIVE TECHNOLOGIES FOR RECOVERING INDUSTRIAL AREAS FROM LCA AND ENERGY EFFICIENCY POINT OF VIEW 2020-1-RO01-KA203-080223

3D PRINTING ON-SITE



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ROMANIA GREEN BUILDING COUNCIL



Rybaki17 Era

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RecoverIND

On-site applications of 3D-printed construction technologies



Ecological and innovative technologies for recovering industrial areas from LCA and energy efficiency point of view

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Introduction

- <u>Challenges</u> of the construction industry:
 - Economic costs
 - Material waste generation
 - Accident rates
 - Time requirements
 - Sustainability
 - Mass customisation

- 3DPC as a possible solution:
 - Customised and complex architectural designs
 - Optimisation of environmental and financial resources
 - New opportunities for automation on-site





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Advantages

- Lower costs
- Higher execution
 speed
- No need for formwork
- Less labor needs
- Increased safety
- Free-form design
- Possibilities of mass customization
- Improved sustainability
- Higher precision
- Improvement of thermal and acoustic performance
- Possibilities of automation and increased productivity









Technologies and equipment

Gantry systems:

- Large-scale printing
- Efficient use of workspace
- Size of the structure

Industrial manipulators:

- Easy transportation
- Complex designs
- Reduced workspace

Mobile manipulators:

- Customized workspace
- Integration of several robots
- Printing complexity

<u>Video</u>

<u>Video</u>



<u>Video</u>



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Programming and optimization

Elements involved in the 3D concrete printing process from design to execution must be considered from a programming and optimization perspective:

- Software for modelling and simulation
- Scripts for execution of tasks
- Printing material mixture
- Material pumping system
- Robotic system
- Printing nozzle

Video roboticist





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Workspace determination

Functional workspace depends on:

- Printing system
- Dimensions
- Printing tool (nozzle)
- Movement constraints

Optimizing:

- Printable size of building elements
- Relative position to the printing system

Video KUKA | prc







Material mixtures

<u>Critical variables of the concrete</u> <u>Do</u> printing process:

- Extrudability
- Open time
- Buildability
- Shape retention factor
- Contraction control



- Cement
- Binder substitutes
- Aggregates



- Additives
- Fibers











Building systems









On-site applications

	Furniture	Sculpture	Component	Wall	Building
Shapes	Aleo o	(P)			
Applications			635		
Description	Wonder Bench, University of Loughborough (UK)	Radiolaria, Enrico Dini, D- Shape- Monolite	Horizontally printed panel, TU Delft (Netherlands)	Double wall, Gosselin (France)	Full printed house, Apis Cor (Russia)



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