R&D PROJECT

Title of the project

Revolutionary Embedded Rail with 3D printing

Acronym

ERRAIL

Content of the project

Traditionally, the most commonly used track type has been ballasted track. Among the main advantages associated with this type of track are its relatively low construction cost, its high elasticity, its ease of maintenance at moderate cost, and its noise absorption capacity. However, other types of track have been developed more recently, such as slab track with embedded rails, as well as new technologies, such as 3D printing, allowing better performance and cost reduction.

The aim of this project is to develop a new solution for embedded rails by additive manufacturing in order to respond efficiently to the problems detected in the embedded rail manufacturing processes.

General objectives

- Development of new high-strength concretes with specific slags for 3D printing for the railway sector
- New strategies for structural reinforcement of embedded rails for their manufacture in a new 3D printing cell
- Optimization of the structural topology of embedded rail systems for their manufacture in the new 3D printing cell
- New process control algorithms

Results and conclusions

The results obtained in the project at the level of research and laboratory tests have been completely satisfactory, fulfilling the objectives mentioned above:

- Both high-strength concrete formulations and railway 3D printing have shown adequate results with the aim of using NERVACERO's white slag as an addition capable of partially replacing the cement content for up to 20%.
- Research has been carried out for the sake of developing an additive printing process for the production of structural elements in an integral way, capable of combining the incorporation of metallic reinforcements in parallel with the 3D printing of concrete.
- Accelerated carbonation has been shown to be a way to improve the properties of White Slag when used in printable mortars, which can increase the percentage of cement replacement without detriment to mechanical resistance.
- The carbonation process has made it possible to replace up to 20% of cement without a significant decrease in mechanical resistance.
- It is feasible to develop printable mortar and concrete formulations with the materials supplied by ARCANOR (limestone crushed aggregates) and NERVACERO (white and black slag). - The formulations developed require a high content of fines (cement, filler and silica fume) to modify their rheology and guarantee their correct behavior during the printing process.
- The ERRAIL-H14 mortar and the ERRAIL-N30 concrete have a high thixotropy that makes them suitable for printing with the systems available at Tecnalia, guaranteeing their pumpability, extrudability and stackability.
- The planning to work with a modular embedded rail has been studied in three scenarios: urban metro, urban tram, and crossing with an existing railway track.

NERVACERO COMSA MECANIZADOS ASUA ARCANORSA Inkatec

BUSSINESS AREAS
Infrastructure area
COMSA, S.A.

DURATION
2020-2022

BUDGET
113.189,73€

KEYWORDS
Embedded rail, high-strength concrete, 3D railway painting

COORDINATOR
MECANIZADOS ASUA

CALL
HAZITEK-2019

EUSKO JAURLARITZA
GOBIERNO VASCO

Europar Batasuna
Unión Europea

Fondo Europeo de Desarrollo Regional (FEDER)
"Una manera de hacer Europa"

Eskualde Garapenerako Europar Funtsa (EGEF)
"Europa egiteko modu bat"