

Artificial Intelligence applied to the reduction of environmental impact in the construction of high-speed rail infrastructures

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Abstract— The development of a society is closely related to the quantity and quality of its infrastructures. Investment in infrastructures such as transport, energy, telecommunications are vital to the development of a country.

It is estimated that global demand for mobility and transport infrastructure for 2050 will be raised by 60% compared to 2010 data [1]. This means a very significant increase in the number of kilometers of roads and railways to build in the coming years.

The report “*Green House Gases EU Transport Emissions: Routes to 2050*” [2] indicated that 28% of total emissions associated with rail transport are due to infrastructure. Nearly half of these emissions are caused during the infrastructure construction process. Most of these emissions are mainly due to material production, transport and earthmoving. The construction of sustainable transport infrastructures is a growing priority in the policies of many countries around the world, including aspects such as social, environmental (related to climate change) and economic impact. Efficiency in the construction and management of transport infrastructure are key to sustainable development goals.

The transport infrastructure, such as high-speed rail lines poses a major effort in construction and even more, in terms of scheduling and resource management. Proper planning of tasks

and resources in construction is essential to improve or optimize the environmental impact.

Under the framework of the European project LIFE12 ENV / ES / 000686, “*LCA, environmental footprints and intelligent analysis for the rail infrastructure construction sector*”, a decision support tool has been developed for the implementation phase, which aims to reduce the water and carbon footprints by 5% and 10% respectively, by the application of artificial intelligence algorithms.

The tool is intended for agents involved in the construction of high-speed rail infrastructure. It allows to model the entire work, and, based on multi-objective evolutionary algorithms [3], to obtain a set of feasible solutions for scheduling tasks and resources. Each of these solutions is part of the Pareto front and quantifies compensations in the satisfaction of the different objectives, or the search for a unique solution that satisfies the subjective preferences of a human decision-making. The goal of this work is to provide a multi-objective evolutionary algorithm to optimize the decision-making process and analysis of building resource-constrained project scheduling for this kind of infrastructures, minimizing the environmental impact.

Keywords—intelligent analysis, carbon footprints, water footprints, high-speed train, jobs scheduling, multi-objective, environmental impact

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Acknowledgment

This work has been partially supported by European Union LIFE+ financial instrument, under grant agreement no. LIFE12 ENV/ES/00068.

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