



Sustainability as a key design factor from the structure conception stage

Ignacio Navarro, Alejandro Ramos, Jose Maria Lorenzo, Jose Luis Sanchez

TYPSA, Spain

Contact: ijnavarro@typsa.es ; imlorenzo@typsa.es

Abstract

Sustainability shall be integrated in the structural design from the early conception of the design, focusing on the impact on carbon footprint. A holistic approach to sustainability and its influence on structural evaluation is key to identify the main factors impacting on carbon footprint. Emphasizing the importance of considering sustainability early in the design process, it connects sustainability with the structure's conception. The case study of the HS2 project's Victoria Road Crossover Box is presented. Initially a standard rectangular box, the final structure evolved into a secant multi-shaft design with 5 bubbles, akin to a Caterpillar's shape. The shift challenged the traditional approach, enhancing efficiency, sustainability and structural behaviour.

The impact of the structural efficiency into the sustainability approach is discussed on this paper and relevant conclusion are stated on the key design factors governing the sustainability approach.

Keywords: sustainability; carbon-footprint; high-speed railway; HS2; caterpillar; early design engagement.

1 Introduction

It is out of any doubt that the sustainable future to which our society is committed is driving the construction sector to face a deep paradigm shift. The conventional way of engineering, struggling to optimise the designs to reach highly cost-effective infrastructures as the only key factor, is almost obsolete nowadays. Today, other aspects, such as the environment and the global value for the society, need to be considered to overcome the challenges of this century. The Sustainable Development Goals in 2015, and the European Green Deal, have changed the paradigm in the construction sector to promote sustainable design and practices.

The European Union has created the frame to encourage engineering sector to reassess not just economic viability but also alignment with the sustainable criteria, influencing the likelihood of funding for 'green' projects. As a result, it's driving a transformative change in the construction sector, promoting innovation and steering away from conventional, less eco-friendly methods towards more socially responsible practices. Local regional governments and private clients have also raised the commitment to achieve climatic goals, aiming to obtain a certain level of scoring in private certification systems, such as ENVISION or BREEAM [1].

Extensive research has been conducted on sustainability matters during the past recent years investigating how to enhance the performance to overcome the aforementioned design pressures.