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ADVANCED BRIDGE SOLUTIONS WITH LOW LIFE-CYCLE COSTS

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SUMMARY

Today's bridge construction projects face new challenges. Public, regulators and authorities demand new structures which are cost effective during their planning, execution, lifetime and dismantling. This translates into a higher relevance to the life cycle costs, and the so-called external costs associated with the execution and maintenance of the structure. A recent independent study has shown that choosing steel sheet pile abutments over the traditional concrete ones leads to a reduction of up to 15% the economic impact during the service life of the structure. The combination of sheet piles with either hot-dip galvanized or weathering-steel rolled sections can further reduce the life cycle costs. The durability of steel and composite bridges can be enhanced by using these alternative protection systems, as they offer crucial advantages over traditional coating systems when considering the bridge's entire life cycle; They do not need any maintenance.

Keywords: *Bridge, Life-Cycle Costs, Corrosion Protection, Hot Rolled, Sheet Pile, Knife-edge Connection.*

1. INTRODUCTION

Bridges have a vital influence in economies, people and merchandise transport networks, military defence strategies, nature and sustainable development. Due to this strategic relevance, the European public, regulators and authorities demand new structures that are highly advanced, cost-effective and sustainable during their planning, execution, lifetime and dismantling. This translates into a higher relevance for the life-cycle costs, and the so-called external costs associated with the execution and maintenance of the structure [1].

Currently, the European bridge market is dominated by concrete bridges. Since projects are mostly chosen according to solely the minimum initial investment, steel and steel-composite bridges are only considered an interesting alternative if additional criteria are required (span > 50 m, aesthetics, clearance, construction time or a reduced overall weight) [3]. However, if a complete cost analysis that considers the full life span of the infrastructure is considered, steel and steel-composite structures may reveal to be the smartest choice [2].

With continuously increasing traffic volumes and gross vehicle weights, the approach of choosing the cheapest construction project seems no longer adequate, especially considering that bridges are long-living structures with a design life of over 100 years. In fact, growing problems like bridge damage, or being able to safely withstand heavier traffic loads during the structure's life-cycle, are usually correlated with long-term impacts on road traffic. These effects have shown the importance of ensuring both the infrastructure's durability and carrying out maintenance, repair, strengthening or replacing work with the lowest possible traffic disturbance, as the average cost per hour that a European passenger spends stuck in traffic is estimated at 20 € [1].

The only way to choose the optimal solution in each situation is to perform a holistic approach that combines several aspects: design and construction costs; Life-Cycle Costs (LCC) – operation, maintenance and repairs; Life-Cycle Environmental Assessment (LCA) – construction, operation and dismantle; Life-Cycle Performance (LCP) [4]; and indirect environmental and economic impact generated by delays, increased fuel consumption and air pollution caused by traffic congestion during the bridges' life-cycle.

Choosing a design with a reduced construction time and low maintenance requirements, becomes a priority when the cost of external effects is considered. Especially as one of the main reasons for slow moving traffic

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