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June 7 - June 8 2018



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## **LIFE CYCLE COST ANALYSIS OF LIGHTING AND PAVEMENT IN ITALIAN ROAD TUNNELS**

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### **Abstract**

Concrete pavements are a valid alternative choice to bituminous conglomerate in road tunnels. Concrete improves safety and sustainability thanks to its technical features. It is durable, non-combustible, it can be produced using recycled materials and it is recyclable itself.

A recent study by Sapienza University of Rome demonstrate economic sustainability of concrete as well. The scope of the research was to provide a tool that facilitate proper decision-making in road management. A life cycle cost analysis (LCCA) of different road tunnels was carried out comparing concrete and bituminous conglomerate pavements. Both pavements (construction and maintenance) and LED lighting system (installation, operation and maintenance) were considered to evaluate total cost during the whole service life. The analysis takes into account three different traffic levels, two service life values (20 and 30 years) and five tunnel lengths, in the range of 750 m to 2000 m.

Tunnel roads design was performed according to national regulations, considering unreinforced jointed concrete for concrete pavement alternative.

The LCCA shows that concrete pavement is the best choice in tunnels. Energy saving, due to lighter colour of concrete surface, and limited maintenance costs due to concrete durability lead to a total saving of 20-26% depending on tunnel length and service life (20 or 30 years).

**Keywords:** concrete, pavement, energy, lighting, LCA, road, tunnel, service life cost.