Innovation in Sustainable Tunnel Ventilation

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1 ABSTRACT

There is increasing interest in the application of sustainability concepts to tunnel ventilation design, installation and operation. This is due to the need to reduce energy consumption as a means of minimising carbon footprint, the commercial imperative to reduce costs at all stages of the infrastructure life-cycle, and the requirement to enhance equipment availability.

The sustainable development concept is based on three main pillars:

- Social: meeting needs in terms of health, education, housing, employment, etc.;
- Economic: creating wealth and improving living standards;
- Environmental: preserving species, natural resources and energy resources.

In the different fields or areas where this concept can be applied, the end-goal of a sustainable development approach is to find a balance between the three pillars and preserve this balance over the long term.

A robust approach to achieving sustainability requires the simultaneous consideration of the social, economic and environmental impacts of any design and operation proposals throughout a tunnel's life-cycle. Statutory requirements, technical guidelines and frameworks should all be considered in formulating holistic strategies for the design and operation of tunnels. The application of such holistic considerations is very challenging, but progress can nevertheless be made through focusing on certain aspects of sustainability, such as reducing operating costs and reducing sound emissions. Tunnel ventilation provides a significant opportunity for sustainability improvements, particularly for long tunnels which can absorb significant amounts of power.

This presentation will focus on successful innovations for achieving sustainable tunnel ventilation systems. These examples include:

1. Low-speed fans, which typically run at speeds of less than 200 rpm. These fans offer a potential reduction in power consumption of 75% compared to conventional axial fans.
2. MoJet longitudinal ventilation, which can reduce the power absorbed by jetfans by up to 30%, or an equivalent reduction in the number of installed jetfans.

In each case, the success factors will be outlined, and further research and development work required to address remaining challenges will be highlighted.