Working group

Tunnels

nvf

Tunnels

Presently, a lot is happening in the tunnel area – especially because of digitisation – of which the potentials and challenges, including safety challenges, must be addressed. Accordingly, a working group is established which will address some of the following matters:

a) Innovation and renewal of methods and materials

Innovation and renewal are important areas in both tunnel construction and maintenance. The group can therefore benefit from sharing knowledge about new materials and new, innovative methods and their consequences, including economic and environmental consequences. For example, it is important to address the environmental aspects of using new, alternative materials that may entirely or partially replace concrete, sprayed concrete, etc.

b) Safety

The group may consider various safety topics. A key topic will be to address the safety challenges related to automated driving. Driverless cars will also be using the tunnels, and the requirements which automated driving place on the technical installations should therefore be considered, together with how these ITS installations will affect tunnel safety. A second topic could be to consider the safety challenges of alternative fuels like batteries, hydrogen and gas, particularly in relation to road users and emergency services. A third topic is cyber security and the importance of being able to ensure reliable and robust communication between emergency services and road traffic information centres.

c) Simulation in virtual reality

Simulation in virtual reality (VR) is already used during the planning and construction phase, however, simulation in VR will also be important during the operation and maintenance phases. The simulation allows tunnel operators and others to train in a virtual environment, organise emergency drills, test up and down grading, safety, innovations, etc. in a safe, but identical environment. In the same way, new procedures etc. can be tested by the competent authorities such as the Danish Working Environment Authority without affecting the accessibility and safety of the tunnels. VR will thus be able to generate a lower Total Cost of Ownership (TCO).

d) Efficient tunnel operation

It is important to know the actual condition and life time of the tunnel in order to be able to carry out predictable maintenance. Practical knowledge within this field is lacking, and the group should therefore communicate knowledge about topics like 'degradation of tunnel components', 'ageing models for concrete' and 'ageing models for joints, transition structures, foundations, etc'. The group may also look at the relationship between (changes in) the physical surroundings of the tunnel (soil, groundwater, changes in water depths and widths, construction of other structures, etc.) and the expected life time. A third topic could be the matter of how changed traffic volumes and changes in urban environment and the national road network will affect tunnel life time. We lack knowledge about the relationship between these parameters and the identification of future risks. This knowledge might be obtained by looking at experience of using datadriven models that, based on new sensor technology, can help monitor and predict the need for future tunnel upgrading.

 Finally, simulation also has a potential in relation to efficient tunnel operation and maintenance of the 'tunnel capital'. A simulation based on data collected from all tunnels makes it easier to predict degradation and faster to detect errors in the technical installations. The budget needed to retain the 'tunnel capital' may be defined more accurately and ensure futureproof capital management.