Tunnels: Safety systems
Going underground

Tunnel technology advances will make driving through underground links considerably safer, writes Mike Woof

With the recent announcement that Denmark and Germany will benefit from a new tunnel connecting the countries, the firms supplying the latest safety technologies are now preparing to compete for potentially lucrative contracts. The tunnel project is expected to cost in the region of £5.1 billion and envisages an 18km long, immersed tube design. This will run under the Fehmarn Belt that lies in-between Denmark and Germany, with state-funding paying for the project.

Planning work is at present being carried out by Femern, a company established for this project by Sund and Beelti Holding, which is owned by the Danish Transport Ministry. Procedural hurdles still have to be crossed however, with the environmental assessment needing to be carried out and full approval of the Danish Government having to be given.

The immersed tube tunnel option was selected mainly on the basis that it would be of lower environmental impact than the alternative cable stayed bridge, as well as being marginally cheaper to construct. The new tunnel linking Denmark and Germany will feature up to 89 sections and carry a four lane highway was well as twin track railway, with construction due to commence in 2014 and be completed in 2020.

As with all tunnels, safety will be a major focus for the project. Fire suppression technology will be a particularly important feature of the safety plans, given that vehicle fires in an 18km long tunnel could pose a significant hazard. This new tunnel will have to be equipped with the latest incident detection technology as well as new fire suppression equipment. These systems are designed to allow anyone trapped in the tunnel to have sufficient time to escape as well as to quench the flames from burning vehicles and prevent damage to the structure. The tunnel safety legislation will also require the link to feature escape routes to allow vehicle occupants to exit quickly from any danger areas.

Meanwhile the incident detection systems will also be of key importance to ensure efficient operation of the tunnel and allow smooth traffic flow, as well as providing necessary alerts to emergency services when required.

Similar technology will be installed in the 2.7km, US$1.09 billion waterfront tunnel planned for Seattle, Washington in the US. Although this tunnel is outside of Europe, its importance means that the US authorities will require similar levels of safety technology as required by European legislation.

One of the latest road tunnels in Europe to be completed is the UK's new Tyne Tunnel link. This 1.5km tunnel has cost £309.1 million (£260 million) to construct and features a sophisticated water mist system to help suppress fires. Prior to the Tyne Tunnel being opened to traffic, the operator carried out a full-scale emergency exercise to test the operating and automated emergency response systems. The Tyne Tunnel is of note as it is the first in the UK to feature the latest fixed, water mist fire suppression systems on the market.

The project has been built by contractor Bouygues Travaux Publics for T22, the New Tyne Crossing Concessionaire and is one of the first major road tunnel links to feature sprinklers. The safety risk posed by fires in road tunnels was highlighted following major disasters in Switzerland and Austria some years back. These showed the difficulties of coping with the heat produced and the lack of access to the fire. However, the activation of an automatic water mist system means that the size of the fire that emergency services would have to be dealt with would be much smaller, increasing safety for the users of the tunnel as well as the fire crews.

The safety features fitted into the Tyne Tunnel include a dedicated, separate pedestrian escape passage, an integrated incident monitoring and alert system, as well as the fixed fire suppression system. In the case of fire in the tunnel, the fixed fire suppression system would generate a mist sufficient to stop a fire from spreading, enabling people to safely escape from the tunnel until the fire service arrives to extinguish the flames. The system not only saves lives but also protects the tunnel structure from fire damage, allowing the tunnel to be re-opened more quickly after an incident. Building the mechanical and electrical systems for the Tyne Tunnel posed challenges as the systems had to be designed specifically for this link, however the experience gained on this project is likely to set precedents for other major new tunnels planned in Europe, such as the Denmark to Germany link.