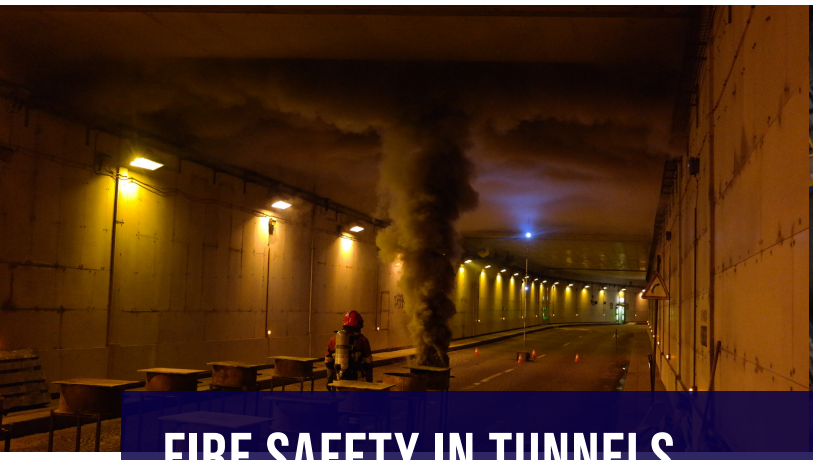
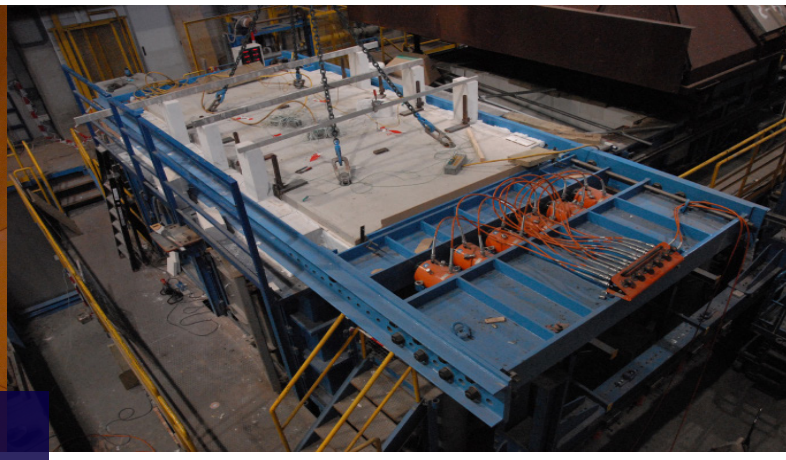
Efectis is an independent third party assessing the fire performance of products, systems, designs and constructions. We can help you worldwide.





FIRE SAFETY IN TUNNELS

ECONOMIC SIGNIFICANCE

The construction of a tunnel is a huge investment in terms of time and money. Tunnels form an integral part of the transport infrastructure network of any country and hence their proper functioning, timely maintenance and above all safety is very important. Tunnel fires expose the vulnerability of a region's dependence on it when a tunnel is closed for days/months or even years due to a fire. This will negatively impact the regional economy as seen in the case of the Mont-Blanc tunnel fire or the Channel tunnel fire.

GLOBAL EXPERTISE IN TUNNEL SAFETY

A significant amount of investment made in the construction of tunnels is related to safety. This cost can be optimized if the early design phase is well-thought in terms of the safety requirements of the tunnel. State of the art knowledge will result in a safe tunnel with robust and reliable safety systems at economical costs. Efectis supports customers in dealing with the challenges of managing the tunnel fire safety and accessibility while keeping the costs in check.

Efectis published in September 2020 an update of its world-renowned test procedure Efectis-R0695:2020, Fire testing procedure for concrete tunnel linings and other tunnel components. This procedure was developed in collaboration with Rijkswaterstaat, part of the Dutch Ministry of Infrastructure and Water Management and is applied across the globe, for example in regions such as China, Scandinavia, the Middle East, the USA and Singapore. Also, Efectis is part of other leading international technical committees on tunnel fire safety such as the NFPA 502 "Standard for Road tunnels, Bridges and other Limited Access Highway" and PFP net "Passive fire protection network".

Efectis carries out testing and calculations according to existing procedures, and furthermore designs relevant and cost-effective test methods. With this competence, Efectis stands apart from others when it comes to advising customers about responsible investment in fire safety measures and achieving optimum performance of the tunnel.

SAFE CONSTRUCTIONS OF TUNNEL LININGS

An important area of work for Efectis concerns structural safety in all its forms. This can be determined with the help of large-scale testing of concrete tunnel linings. For such a test a concrete element which is representative of the construction on site is necessary. This means a representative concrete mix and geometry (including reinforcement) compressive stress.

Efectis has an external loading frame to create the loading conditions present in a tunnel segment during the fire test. The frame may be used to test slabs as well as curved segments (TBM). Efectis has the capacity to apply any popular tunnel temperature-time curve (ISO, RWS, HC, HCM), both horizontally and vertically. The combination of above traits enables the client to perform cost-effective and representative tunnel tests.

ON SITE TESTING WITH THE EFECTIS MOBILE FURNACE MOBIFIRE®

Efectis is the first company in the world able to perform realistic fire resistance testing on-site using a mobile furnace. In the last 15 years, Efectis has only strengthened this position further with its signature concept, MobiFire®, which stands for Mobile Fire Resistance. MobiFire® can follow any tunnel temperature-time curve (ISO, RWS, HC, HCM). The mobile furnace is a great option for tunnel owners who want to upgrade the fire safety of existing tunnels. Over the last few years, Efectis has performed numerous research studies on existing tunnels to help tunnel owners reach an optimal safety solution and upgrade the fire safety level.

FIXED FIREFIGHTING SYSTEMS (FFFS) FOR TUNNELS

Efectis is a leader in large scale testing of Fixed FireFighting Systems (FFFS), and has performed numerous tests with sprinklers, water mist and other innovative technologies. A 600 m long tunnel dedicated to fire tests is an infrastructure example where FFFS systems are installed, and their performance is tested. Parameters which are tested include; activated water zones, ventilation type and speed, fuel type, fire size, detection system and tunnel cross-section. By means of all configurations, The FFFS systems can be optimized for fire control, fire suppression or other performance criteria such as tenability (visibility, CO, FED or thermal) or structural integrity.

ON SITE VENTILATION SYSTEM MEASUREMENTS AND SMOKE TESTS

Ventilation systems are used in tunnel to control air renewal and to extract smoke. In the event of a fire start, it is essential to ensure the correct operation of this equipment for all the procedures contributing to the safety of the tunnel. Hence on site tests are effective means of validating the characteristics of the installations as well as their implementation under realistic conditions.

The performance evaluation of ventilation systems are carried out in various ways:

- By "cold" aeraulic measurements in the duct, exhaust and tunnel itself in order to a assess the various flow rates, longitudinal velocities, pressure differences, and any leaks;
- By using controlled generation of smoke and heat to visualize the flow and accumulation of smoke, the natural stratification of the smoke and to reproduce the conditions of loss of visibility.

Tunnel safety actors must be properly prepared to deal with any event occurring in the tunnels. Regular safety exercises or drills are a good way to maintain their ability to respond effectively. The generation of smoke and heat brings a high degree of realism allowing participants to be placed in conditions close to what they might encounter in the field.