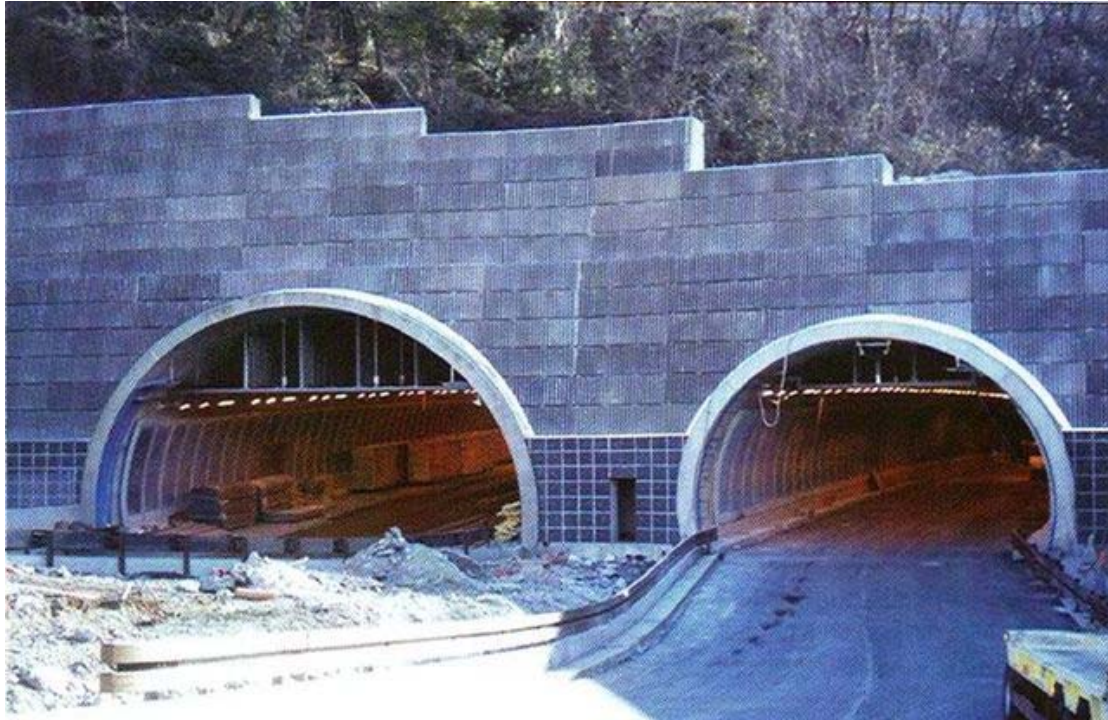


Installation of FireBarrier 135 in the Lecco Tunnel, Italy



The city of Lecco is located in a strategic economic area of northern Italy. This new road tunnel has been constructed under the city to improve traffic flow through the city and the region. The original project commenced in 1980 and consists of 3 different tunnels. The primary tunnel is 5.8 Km long with ventilation ducting and an escape passage located above the 160mm thick concrete tunnel roof. Passive fire protection of the tunnel structure is required to comply with the new EU Directive for Fire Safety of Tunnels. This requires that all the critical parts of the tunnel structure are insulated against the effects of a fire. The material chosen to provide this critical fire protection was FireMaster FireBarrier 135; a highly insulating refractory sprayed cement capable of withstanding 1350 °C.

Fire Protection Requirements

Fire protection was required for the tunnel roof, all ventilation ducts and the escape passages in the central section of the tunnel to ensure a 120 min fire resistance when exposed to the 1300 °C HCM (Hydrocarbon max) fire curve.

In areas where main roads join the tunnel (where only ventilation ducts are present), a 120-minute fire protection was required against a cellulosic fire in accordance with the ISO 834 fire curve.

FireBarrier 135 Tunnel Fire Protection Systems

Structural steel beams located in the central section of the tunnel are also required to maintain their load bearing properties for 120 minutes when subjected to the 1300 °C “HCM” Hydrocarbon fire heating regime.

Each of these applications has a different critical temperature that must not be exceeded in a fire. Fire insulation is required to ensure this critical temperature will not be exceeded when exposed to the varying temperature curves described above.

Proving the Performance of FireBarrier 135

Due to the varying levels of protection required, engineering of the FireBarrier 135 lining was complex.

A fire test was carried out at the CSI laboratory, Italy to confirm the correct design for protection of the concrete roof slab against the 120 minute HCM fire curve. This test determined the correct thickness of FireBarrier 135 that would need to be applied to prevent the concrete spalling and subsequent collapse of the roof. Only 28mm of FireBarrier 135 was required to achieve this. The same thickness has also been used to protect the wall of the escape passage running above the roof slab.

For the concrete structure, Finite Element Modeling was used to determine that a thickness of only 12mm would be sufficient to maintain its temperature below 30 °C during a two hour ISO 834 cellulosic fire.



Steel structures during installation of wire mesh

Connection tunnel completed

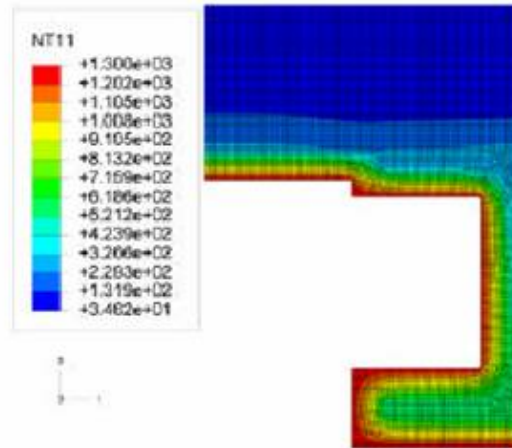
Using Finite Element Modeling, 35mm of FireBarrier 135 was used to maintain the steel beam average temperature below 450 °C during a HCM fire of 120 minutes duration.

For all the structure located in the tunnel roof, FireBarrier 135 was applied using a traditional spray gun machine with a wire mesh installed beforehand.

FireBarrier 135 Tunnel Fire Protection Systems



Steel structures installed



Example of modeling of steel Beams and reinforcement



View of central part of tunnel



Connecting tunnel in south area



FireBarrier 135 Tunnel Fire Protection Systems

View of central part of tunnel after completion of installation of FireBarrier 135 .

