Specialists in Tunnel Fire Protection
Specialists in Tunnel Fire Detection

Underground transport facilities are sensitive links in the economic chain that carry thousands of people and tons of goods every day and they are increasingly more important to society.

A breakdown in operations can have catastrophic consequences, hence the need for comprehensive safety precautions and ensuring that the design, installation and maintenance of these systems is of the highest standard. By far the greatest risk is an uncontrolled fire, as fires represent great danger to life due to toxic combustion gases, high temperatures and loss of visibility. In addition, the limited means of escape available together with panic reactions spell disaster for any tunnel operator and the future viability of the transport facility.

**DETECTION IN TUNNELS**

In today's complex industrial environments, the potential for financial losses caused by overheat and fire can be disastrous if not detected and located quickly.

Linear Heat detection is increasingly becoming the first choice in fire protection. With ever increasing complex applications and the potential for loss and downtime, the right choice is critical to business continuity. In many applications traditional point type detection is not used in the way and for the purpose they were designed. Linear heat detection has become a preferred alternative for many of these applications.

**LINEAR HEAT DETECTION**

Digital linear heat detection cable is a conventional style heat detector which is capable of detecting a fire along the entire length of the cable using a maximum alarm threshold. Its versatility and simplicity is an economic way to provide rapid detection of fire at an early stage.

**FIBRE OPTIC LINEAR HEAT DETECTION SYSTEMS**

Are capable of recording temperatures along the entire length of the sensor cable providing continuous real time temperature profile of the environment in which the system is installed. These systems are capable of detecting and locating a fire or overheat conditions over distances up to 10 km.

**MICRO CHIP LINEAR HEAT DETECTION SYSTEMS**

Rapidly and accurately detect temperature changes at ±0.1°C increments along its length, with multiple alarm thresholds including fixed point, rate of rise and pre alarm. The system controllers include the ability to program various alarm thresholds which interface with fire control and building automation systems upon fire alarm. In turn providing real time data of any fire scenario to operational personnel as well as accurately operating the fire suppression systems to activate where required.

**FLAME DETECTION**

Flame detectors provide high speed detection of flaming fires with the option of an in-built CCTV camera for real time footage of fire scenarios. These detectors are capable of operating in the harshest environmental conditions and offer a solution for virtually any application. With a high immunity for false alarms, as well as various performance and safety approvals, flame detectors are a reliable alternative for fire detection throughout tunnels including sump areas within the structure.

**VIDEO IMAGING DETECTION (VID)**

SigniFire cameras can see and recognise smoke and/or flames overlooking large spaces at great distances, whilst also providing video surveillance capabilities. The benefits for VID in a tunnel application, is that, trained tunnel operators have the ability to visually recognise real fire and smoke events and operate fire suppression systems accurately to the location of the fire. As the VID system can detect fire within seconds, supplying vital situational awareness in the form of live video to remotely located control centres, trigger fire alarms, and provide vast amounts of pre-recorded video forensic evidence for future fire investigations.

SigniFire is deployed in conjunction with the Fike FSM-IP advanced Network Video Recorder (NVR) platform that can address immediate security needs of your organisation. Large capacity internal storage provides continuous digital video recordings with instant access to current and archived events from virtually anywhere over local and public networks.

**ASPIRATING SMOKE & GAS DETECTION**

VESDA very early warning smoke detection solutions provide the earliest possible warning of an impending fire hazard. VESDA buys time to investigate an alarm and initiate an appropriate response to prevent injury, property damage or business disruption. And because VESDA has the industry’s widest sensitivity range and multi-level alarms, even minute levels of smoke can be detected before a fire has time to escalate.

As the No. 1 ASD brand specified by fire professionals around the world, VESDA is synonymous with reliable, high-performance fire detection.
WATER MIST PROTECTION OF TUNNELS

The protection of people against fire and other risks is one of the major tasks of tunnel designers and operators. Furthermore, the closing of a tunnel for days, weeks or even months after a fire incident can create huge economic losses not only for the operator but also for society as a whole. Intensive research work over the last decade has shown that commonly applied fire protection concepts for tunnels may not provide a sufficient level of safety.

Smoke ventilation systems are designed to deal with a specific, limited fire size. Passive fire protection is designed to withstand the effects of fires for a limited time only. It is now accepted that there is a more important need to provide protection for people that may be trapped and trying to escape the smoke and flames.

The logical and most effective way to provide suitable protection for tunnels and its users is to install fixed fire fighting systems (FFFS) to mitigate the effects of fires. FOGTEC Tunnel Protection Systems are state of the art Water Mist Systems combining results of the latest research work with the reliability of long term tested components.

Modern FFFS Technology with Low Investment Costs:

FOGTEC technology makes it possible to reach a high safety level with low investment costs. Revolutionary cost benefit analyses have shown that investing in FFFS will give return on investment over the design lifetime of the tunnel. This is due to low life cycle costs of modern FFFS technology.

FOGTEC’s Tunnel Research:

FOGTEC operates its own research facilities including fire test laboratories. A number of research projects specifically designed for the protection of tunnels have been carried out by FOGTEC over the last 10 years, providing a unique and proven basis for design.

LIFE SAFETY & ASSET PROTECTION

Purpose of (FFFS):

High pressure Water Mist Systems (WMS) are installed to improve both life safety and asset protection within tunnels. As WMS are active fire fighting methods they achieve this by:

1. Improving the self-rescue conditions
   - Immediate cooling effect to provide lower temperatures within the fire zone.
   - Reducing smoke production significantly by controlling and suppressing the fire.
   - Binding smoke and soot.

2. Improving access and operating conditions for fire and rescue services
   - Limiting Heat Release Rate (HRR) with suppression and control
   - Lower temperatures
   - Blocking radiant heat transfer.

3. Prevention of fire spread between vehicles
   - Limited fire area
   - Limited HRR.

4. Limiting structural damages to the tunnel
   - Lower temperatures
   - Limited HRR and fire area

The benefits of FFFS are especially evident in cases where loaded semi-trailers or buses are involved in the fire. Both the UPTUN and SOLIT research programs showed the distinct benefits in such scenarios. The SOLIT research program used 150MW-200MW HRR (approx.) class A mock-up as the design fire load.

Although the fire load represented a typical loaded semi trailer scenario similar to many catastrophic fires, all of the above mentioned objectives were successfully reached.

It has to be noted that modern FFFS are used for fire control and suppression purposes, therefore HRR can be even tens of megawatts in peak output. However, the fire is encapsulated with water mist and more importantly heat / temperatures are kept under control.

Water mist Systems are able to control/ suppress even large fires and systems are capable of fire encapsulation and temperature limiting which provides safe conditions for emergency fire services.

THE SMARTER WAY OF FIRE FIGHTING WITH WATER MIST

FOGTEC Watermist Systems for Tunnels generate a fine water mist around the fire. Very small water droplets provide an efficient cooling mechanism to mitigate the effects of the fire.

High Pressure Water Mist nozzles are installed throughout the tunnel and are grouped in sections or zones that can be individually activated. As a result of the system’s 200 bar pressure, long pipe runs are easily accommodated and costs are kept low due to smaller pipe sizes.

Pumping systems are available as diesel and electrically driven units. Compact state of the art design avoids the use of multiple small pumps being connected in parallel. Thus, reliability levels are high and service and maintenance requirements are low. FOGTEC Systems are easily integrated into tunnel management systems for optimal interconnection with other safety systems such as ventilation and emergency warning systems.

WATER MIST SYSTEM ARCHITECTURE

1. The water supply main is pre- pressurised to section (zone) valves in order to reduce water delivery time.
2. Each fire suppression zone is fitted with an automatic section (zone) valve.
3. Fogtec nozzles are specially engineered and fire tested for tunnel applications in extreme fire conditions, these nozzles are designed to generate fine water mist droplets that provide a superior cooling effect which is required to achieve a sharp reduction in the fire heat release rate.

Example from real installations

These pictures show a typical water mist installation in the tunnel (3D model) and an activated system in the real tunnel.
PARTICIPATION IN STANDARDISATION & RESEARCH PROGRAMS
Fire Protection Technologies and FOGTEC are very active in Australia and throughout the world in tunnel societies and participate in a number of different research programs, standards, committees and working groups.

- NFPA 502 (Tunnels)
- NFPA 750 (Water Mist)
- ITA - COSUF
- Australasian Tunneling Society
- Technical Advisory Committee (TC23) Tunnel Fire Safety
- International Water Mist Association

Fire Protection Technologies have provided and continue to provide design, engineering, fire suppression products, fire detection products, and commissioning services for new tunnel projects, upgrades and refurbishments. Our experienced design and engineering team is intimately aware of the stringent engineering requirements that apply to tunnels.

FOAM FIRE FIGHTING SYSTEMS
Fire-fighting foam is an aggregate of air-filled bubbles formed from aqueous solutions and is lower in density than flammable liquids. It is used principally to form a cohesive floating blanket on flammable and combustible liquids and prevents or extinguishes fire by excluding air and cooling the fuel.

It also prevents reigniting by suppressing formation of flammable vapors. It has property of adhering to surfaces, which provides a degree of exposure protection from adjacent fires.

TYPICAL FOAM APPLICATION AREAS
Localised Applications:
- Car Fire (Engine, Brakes, Tyre,)
- Truck Fires (Tyre, Engine bay, Brakes, Trailer)
- Hydrocarbon Spills

Hydrocarbon Catchment Sump/Run off Areas:
- Tunnel Low point Run off areas
- Hydrocarbon Sumps
- Catchment separators

FOAM ADVANTAGES IN LOCAL APPLICATIONS
- Localised Rapid response Spill/Fire application
- Rapid Suppression (knock down)
- Foam Blanket Vapour containment
- Enhanced burn back resistance
- Personal Safety increased through proximity of hose reel throw distance
- Water Enhancement = reduced water consumption

FIXED FOAM SYSTEM ADVANTAGES IN CATCHMENT/CONTAINMENT AREAS
- Early Detection (Hydrocarbon or Flame Detection system)
- Foam Blanket Vapour containment
- Rapid Suppression (knock down)
- Enhanced burn back resistance

TUNNEL PROJECTS AUSTRALIA & NEW ZEALAND
Fire Protection Technologies have provided and continue to provide design, engineering, fire suppression products, fire detection products, and commissioning services for new tunnel projects, upgrades and refurbishments. Our experienced design and engineering team is intimately aware of the stringent engineering requirements that apply to tunnels.
PRODUCTS:

**Gaseous Suppression**
- Inert Gas (IG-01, IG-55, IG-100, IG-541)
- Novec 1230™ Fluid (FK-5-1-12)
- FM-200® / NAF S 227 (HFC-227ea.)
- Ecaro 125® / NAF S 125 (HFC-125)
- Carbon Dioxide (CO₂)
- Hybrid Systems (N₂ / Water)
- Pressure Relief Vents
- Enclosure Integrity Testing Equipment
- Pipe & Fittings

**Water Suppression**
- Water Mist - High Pressure
- Water Mist - Intermediate Pressure
- Water Mist - Low Pressure
- Hybrid Systems (Water / N₂)
- Monitors & Delivery Systems
- High Speed Deluge

**Foam Suppression**
- Foam Concentrates
- Foam Proportioning
- Foam Delivery Systems
- Foam Concentrate Testing

**Explosion Protection**
- Explosion Suppression
- Explosion Isolation
- Explosion Vents & Pressure Relief
- Spark Suppression
- Explosibility Testing

**Fire Detection**
- Linear Heat Detection - Digital
- Linear Heat Detection - Fibre Optic
- Linear Heat Detection - Micro Chip
- Flame Detection
- Video Imaging Detection
- Spark Detection
- Control & Indicating Equipment
- Thermal Imaging Detection
- Aspirating Smoke Detection

**Military & Defence**
- Military Vehicles
- Naval Vessels

**Special Applications**
- Micro Environment
- Oxygen Reduction
- Kitchen Protection Systems
- Dry Chemical
- Vehicle Systems
- Compressed Air Foam
- Marine & Offshore
- Vapour Mitigation

**Support Services**
- Design / Engineering
- Technical Support
- Services & Testing

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