PROMATECT®-H
Tunnel Soffits/Walls Lost Shuttering

Fires in tunnels are a major hazard to human life and can cause costly damage to infrastructure. The limited escape facilities and the difficulties encountered by intervention forces gaining access call for extensive safety arrangements which must be complementary and mutually coordinated.

Tunnels and underground transport facilities are important means of communication, not only in terms of shorter journeys but increasingly for consideration of the local population and the environment. Generally speaking, important underground transport links are expected to be available without any restrictions and to operate smoothly round the clock. Interruptions due to accidents, technical malfunctions or maintenance work quickly cause traffic jams and delays, and figure in transport policy statistics as economic losses.

Rising traffic densities and the growing demand for underground communication links result in a higher probability of accidents, injuries and damage. Added to this are other factors which increase the potential hazards of traffic tunnels:

- The increasing length of modern tunnels,
- The transport of hazardous materials,
- Two-way traffic (with undivided carriageways),
- Higher fire loads due to growing traffic volumes and higher loading capacities,
- Mechanical defects in motor vehicles.

When considering tunnels, it is usually in relation to road and rail infrastructure. However, use of the word tunnels can be slightly misleading, as the following details apply equally to pedestrian walkways, underground rail stations, underground car parks etc, in fact, to any concrete structure. Therefore, although this section refers to tunnels throughout, all details also apply to underground spaces and concrete structures of any description.

It is usually assumed that because a structure is constructed using concrete, that it is inherently fire resistant and therefore requires no additional fire protection measures to be taken.

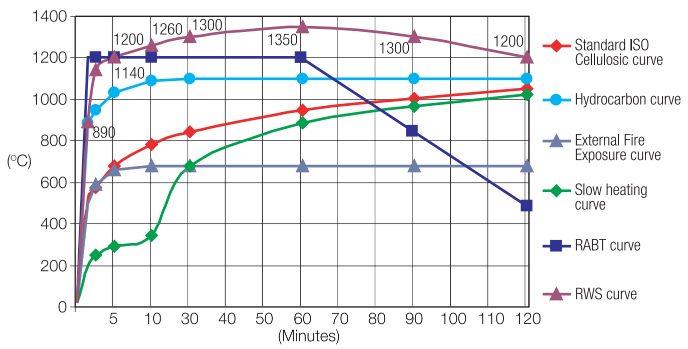
Unfortunately, experience over the years has shown that this is not necessarily the case and consideration must be given to the performance and behaviour of concrete structures under fire conditions. In addition, where tunnels and underground spaces are concerned, attention must also be paid to the provision of services protection, e.g. smoke extraction systems, protection to cables and wiring servicing emergency equipment etc. Please refer to the relevant sections in this handbook.

For more specific information concerning the fire protection of tunnels, please contact a local Promat sales office to obtain a copy of the appropriate literature related to fire protection of tunnels and underground spaces.

See the following details concerning the appropriate fire curves pertinent to tunnels.

Fire Testing Methods: Fire Curves

The fire performance of any system will vary depending on the heating conditions it is exposed to. Different national and international fire curves have been developed to simulate fires carried out in fire test furnaces, by recognised national organisations. These include:



1. The Standard Cellulosic Time-Temperature Curve

This ISO-based curve is used in standards throughout the world, including BS476, AS1530, DIN4102, ASTM, and the new European Norm (EN). It is a model of a ventilation controlled natural fire, i.e., fire in a normal building. The temperature increase after 30 minutes is 842°C.

2. The Hydrocarbon Curve

This curve is a simulation of a ventilated oil fire with a temperature increase to 1110°C after 30 minutes. The Hydrocarbon Curve is applicable where petroleum fires might occur in an open enviroment, i.e. petrol or oil tanks, certain chemical types etc. In fact, although the Hydrocarbon Curve is based on a standardised type fire, there are numerous types of fire associated with petrochemical fuels which have wide variations in the duration of the fire, ranging from seconds to days.

3. The RABT Curve

This curve was developed in Germany as a result of a series of test programmes (e.g. the Eureka project) into the effects of fire within enclosed spaces such as road and rail tunnels. In these situations, the inability of the heat to dissipate in to the atmosphere, and the flue like effect of the tunnel geometry feeding air to a fire (similar to a blacksmiths bellows) results in much faster fire growth and higher temperatures. In the RABT Curve, the temperature rise is very rapid, up to 1200°C within 5 minutes. The duration of the 1200°C exposure is for either 30 or 60 minutes, depending on type of tunnel (e.g. road or rail). The temperature then begins to drop as this curve has a defined "cooling off" period of 110 minutes.

4. The RWS Curve (Rijkswaterstaat)

This model of a petroleum-based blaze is based on a 300MW load fire occurring within an enclosed area such as a tunnel. Developed in the Netherlands specifically for use in tunnels, it is internationally accepted. For instance, the 2007 edition of NFPA 502 will require tunnel structures to be protected to the RWS level of exposure. The temperature increase after 30 minutes is 1300°C with a peak of 1350°C.

5. The External Fire Exposure Curve

This model is for fire exposure external to a building and open to the atmosphere, where there are additional possibilities for heat dissipation resulting in lower fire temperatures. There is a consequential lower level of heat exposure. Temperature increase is approximately 680°C after 20 minutes and remains constant throughout.

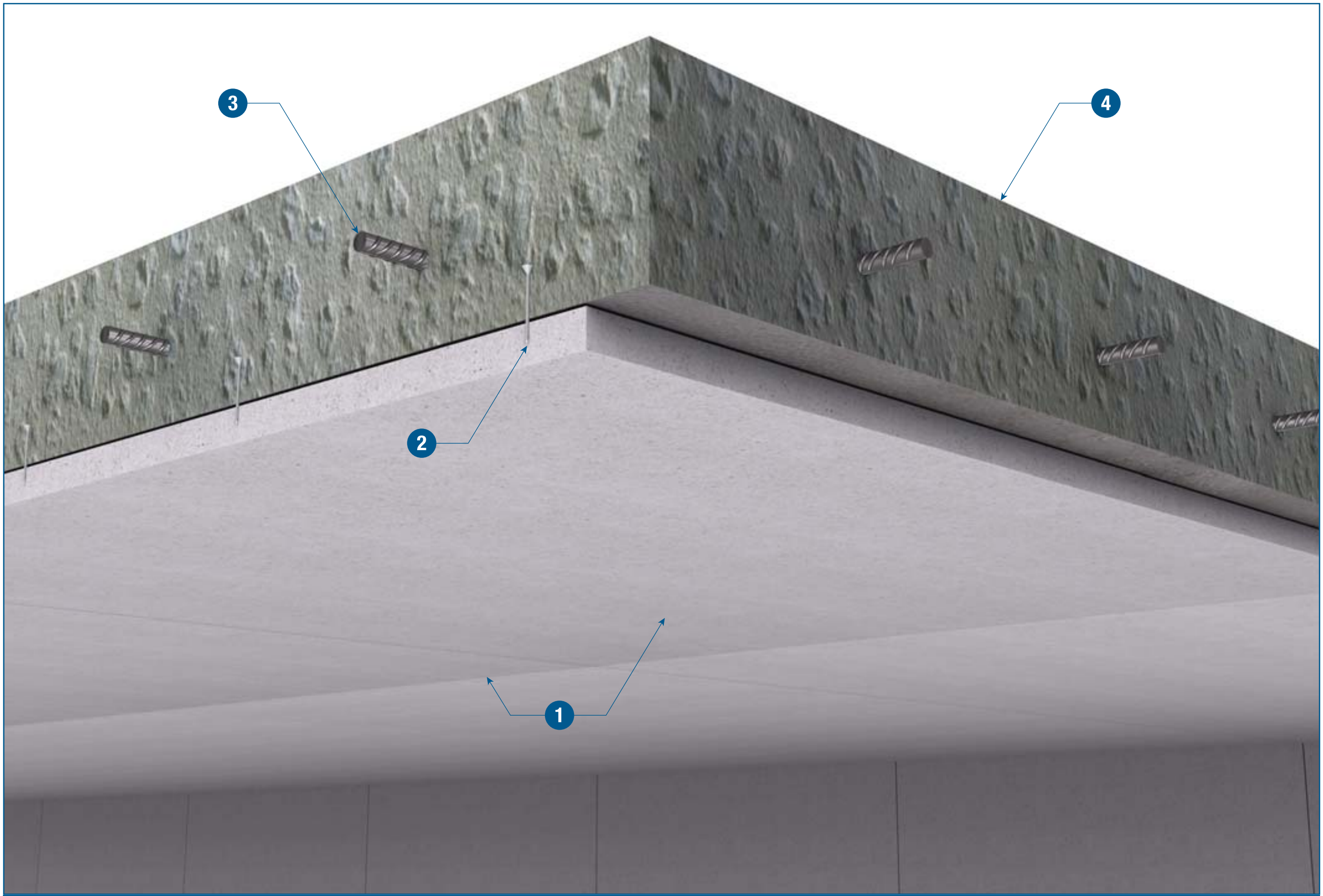
6. The Slow Heating Curve

This curve simulates a slow growing fire. It is basically a combination of two curves, one for the first 21 minutes representing the smouldering effect of materials and one for subsequent periods representing the growth of the fire towards flashover.

7. Furnace Pressure

As well as controlling the exposure temperature, the test standards require that the air pressure within the test furnace is maintained at a positive level in an attempt to create a worse case scenario and force hot gases and flame though the specimen under test. In addition, thermocouples are fixed to the unexposed face of the specimen to measure the performance of the system against the transfer of heat from the hot to the cold face of the specimen.

Fixing with self-tapping screws as permanent formwork



TECHNICAL DATA

1 1 layer of PROMATECT®-H board

For FRL of 120 to RWS	27mm thick for soffits
For FRL of 240 to Hydrocarbon	25mm thick for soffits 20mm thick for walls

2 Appropriate grade of stainless steel M4 self-tapping screws

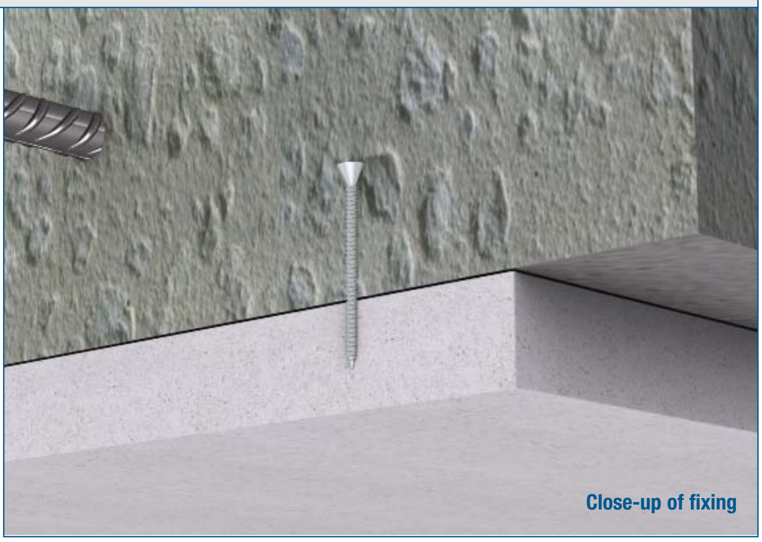
For FRL of 120 to RWS	60mm long x 8 points per m²
For FRL of 240 to Hydrocarbon	60mm long x 8 points per m²

3 Steel reinforcement

4 Concrete structure

The board thickness of the protection material is relevant to the strength of the concrete and the cover to the reinforcement. In some instances such as very high strength concrete, a greater thickness of protection material may be required.

This installation method is provided as a general guideline only, please contact Promat Technical Department for specific requirements.



Close-up of fixing

For latest information of the Promat Asia Pacific organisation,
please refer to www.promat-ap.com

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