



Introduction

Concrete is the most widely used construction material on earth and has proved to be very durable under most conditions. Due to several tunnel fires in Europe and the increased threat of terrorism, public attention has been focused on the performance of structures both above and below the ground. Passive Fire Protection applies to both the safety of people and the safety of the structures. Structural integrity in the event of a fire will also have an impact upon the safety of people when heavy objects and/or hot spalling concrete falls on people.

Underground Construction

Over the last decade ADFIL's polypropylene fibres have been used in many tunnels, primarily to enhance the fire rating of the concrete structure. This product has been proven many times at such test facilities as: TNO, Holland and the BRE, England. The fibres have been used in applications such as sprayed linings, precast segments and pumped concrete behind slip formed shuttering.

Potential Problems

The Phenomenon occurs when concrete is exposed to high temperatures such as those experienced during a hydrocarbon fire. The high quality dense concrete that is associated with tunnelling projects means that in the event of a fire, moisture escaping from the heat source, cannot escape quickly enough. Any voids that are present within the concrete soon become saturated.

As the heat overtakes the moist front, the moisture starts to vapourise and increases pressure within the concrete voids. The result of such excessive pressure is explosive spalling. This spalling occurs rapidly and has affected emergency personnel and passengers in transit from either entering the area in an attempt to bring the fire under control, or hindering others from fleeing the effected area. This has led to fatalities or serious injury.

Often tunnels cast in-situ can suffer from plastic shrinkage cracking, which on occasions penetrates through the full thickness of the concrete. This plastic cracking will reduce the permeability of the tunnel lining.

How ADFIL polypropylene Fibres can solve the problem

ADFIL's specially designed monofilament fibres are added to the concrete mix for the purpose of increasing permeability during heating, thus reducing pore pressures and the risk of spalling. The fibres will start to melt when the heat generated is approximately 160°C.

When the temperature reaches 360°C the fibres will disintegrate to provide millions of capillaries in the concrete for the moisture to escape. Therefore there is no build up of pressure and hence no explosive spalling.

Furthermore, polypropylene fibres offer a three – dimensional system, which helps to prevent shrinkage cracks from occurring. The fibres increase the tensile strain capacity of the mix at the plastic stage whilst crack control reinforcement would merely hold the cracks together once the concrete has failed. Polypropylene fibres should not be used as an alternative to primary of structural reinforcement.

Features and Benefits

- Reduced Explosive Spalling
- Reduced Construction Time
- Reduced Labour Costs
- Reduced Permeability
- Fibres Will Not Rust or Corrode
- Improved Resistance to Plastic Shrinkage Cracks
- Provides a 3-Dimensional Secondary Reinforcement System