Case studies

North Downs Tunnel, Kent
The 3.2 km North Downs Tunnel forms part of the Channel Tunnel Rail Link running from Folkestone, Kent to St. Pancras in London. The primary tunnel lining was made up of sprayed concrete. 1 kg of IGNIS® PP monofilament fibres were added to the C30/37 concrete secondary lining. The lining was constructed in situ, forming a sacrificial layer.

De Westerschelde Tunnel, the Netherlands
The client, Roadline BV instructed the precast contractors to add 1 kg of Ignis to the C40 concrete. The fibre was included in the concrete sections forming the security exits, safety barriers and connection tunnels.

Dublin Port Tunnel, Ireland
Ignis has been added to Grade C60 concrete on various contracts within this prestigious project. The Ignis enhanced concrete has been used on site in sprayed concrete applications and it has also been added to precast ring segments at a purpose built factory in Raham Bore.

T5, Heathrow Airport
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T5, Heathrow Airport, London

Dublin Port Tunnel, Ireland
This 4 lane underground highway is designed to take heavy vehicle traffic off the streets of Dublin. A 275 mm thick lining over the tunnels arch is a non-load bearing sacrificial concrete containing 1-2 kg of Ignis.

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Concrete is the most widely used construction material in tunnels around the globe. Due to several tunnel fires in Europe and the increased threat of terrorism, public attention has been focused on the performance of concrete structures both above and below the ground. Passive fire protection that safeguards structural integrity in the event of a fire is of utmost importance for the safety of tunnels. Without such protection, heavy objects and/or hot spalled concrete can pose a serious threat.

### Benefits

- Increased abrasion and impact resistance
- Improved resistance to plastic shrinkage cracks
- Prevention of explosive spalling
- Crack control
- Passive fire protection
- Enhanced abrasion and impact resistance

### Tech details

- Polypropylene monofilament fibre
- Equivalent diameter: 18 μm
- Shape: Monofilament
- Fibre length: 6 mm
- Specific gravity: 0.95 kg/dm³
- Fiber count: 718 mio.

### TNO

Back in 1999 TNO proved that the use of monofilament fibre gave the best results when compared to fibrillated fibres in avoiding explosive spalling. A year later, the institute used the RWS Fire Curve on a number of concrete samples that contained 1.2 and 3 kg/m³ of ignis monofilament polypropylene fibre. The samples were loaded to 6.5 N/mm². The RWS Fire Curve models a severe hydrocarbon fire curve that rises rapidly to 800°C in three minutes and peaks at 1300°C. The samples were subjected to compressive forces during the test; equivalent to the design loadings predicted in the tunnel lining of the Channel Tunnel Rail Link project. The plain control sample suffered extensive explosive spalling up to a depth of 120 mm. The sample containing 3 kg of Ignis fibre showed no evidence of spalling after two hours of testing.

### BRE

Sampling containing granite-aggregates and ignis monofilament polypropylene fibres were exposed to a severe hydrocarbon fire curve that rises rapidly to 800°C in three minutes and peaks at 1300°C. The samples were subjected to compressive forces during the test; equivalent to the design loadings predicted in the tunnel lining of the Channel Tunnel Rail Link project. The plain control sample suffered extensive explosive spalling up to a depth of 120 mm. The sample containing Ignis fibres showed no evidence of spalling after two hours of testing. Even the mixes containing lightweight aggregate which totally disintegrated during the initial tests, showed no spalling when Ignis fibres were added.

### Testing

**Proven performance**

Extensive testing at independent laboratories such as TNO (NL) and BRE (UK) has proven that ignis significantly enhances the fire rating of concrete structures.

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