



# Full-field experimental and numerical investigation of novel fire resistant fibre reinforced concrete for tunnel lining (FiRe2C)

## › Project objectives

- Background: Spalling of concrete (i.e. flaking of concrete surface) during fire causes serious damage to concrete structures, with significant economic costs and risk to human life. Stronger, more durable concretes tend to spall more. To overcome this, fibres are used to reinforce the concrete. However, fibres tend to reduce the strength of the concrete.
- Manufacture a new type of **high strength, fibre reinforced, fire resistant concrete** to improve the design of tunnel concrete linings

## › Project team



Dr Karatza  
*Fellow, NTUA*



Prof.  
Badogiannis  
*Supervisor, NTUA*



Prof. Nomikos  
*Director of the  
laboratory for  
tunnelling, NTUA*



Dr Hall  
*LINXS institute, Lund,  
Sweden*



# Full-field experimental and numerical investigation of novel fire resistant fibre reinforced concrete for tunnel lining (FiRe2C)

## › Main project methodology & impact

### Method

- Optimise the design and production of new types of fire resistant, fibre reinforced concrete, building up from past research of the supervisor, Prof. Badogiannis<sup>1</sup> → “Green concrete”, i.e. lower carbon footprint, more durable
- Study experimentally the effect of size, distribution and orientation of the fibres on the strength and fire resistance of concrete linings, by employing x-ray computed tomography, exploiting the expertise of the fellow, Dr Karatza<sup>2</sup>
- Create a novel numerical model to accurately predict the strength and fire resistance of the new concrete

### Impact

- Increase in vehicles → increase in construction rate/size of tunnels → better concrete linings → reduction in time and costs required for the restoration of a tunnel after a fire incident
- Improvement of Fire Standard Regulations

<sup>1</sup> Choumanidis et al. 2016 Constr. and Building Materials 129 pp. 226-277

<sup>2</sup> Karatza et al. 2019 Granular Matter 21:44