

FIRE PERFORMANCE OF SECONDARY TUNNELS LINING WITH DIFFERENT FIBER COMBINATIONS

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This research plan has been designed in order to increase security in the tunnels in case of fire and to find effective and optimal solutions for fire protection of tunnel lining. The focus of this research plan is to find solutions for reducing the explosive spalling of concrete which in case of fire directly endangers human lives, interferes with firefighters while rescuing people and causing significant material damage. Previous studies that have been conducted mainly on reinforced concrete with polypropylene fibers have produced good results in terms of resistance of such concrete to fire action. The plan is to explore that area in more detail in terms of fire resistance regarding the secondary tunnel lining made of reinforced concrete with different combinations of microfibers with an emphasis on the use of recycled microfibers. In addition to fire resistance research in this study we will be exploring the economic component of each of the tested combination and the possibility of simple preparation and installation of such concrete.

As a basic reference sample type we will examine concrete reinforced with polypropylene (PP) fiber (22mm long with 32 μ m diameter). Second type of sample will be reinforced with recycled polyethylene terephthalate (RPET) microfibers. The other five types of samples will be reinforced with a combination of two or three types of fibers - hybrid fibers (H). Hybrid fiber combination H1 is a combination of PP and steel microfiber. H2 is a combination of RPET and steel fibers. H3 is a combination of three fibers from recycled car tires, first one is composed of polymeric tire cords (RTF), second one is composed from recycled tire – rubber strips (RTR), which were the main component of tires, and the third is composed from recycled tire steel fibers which were the radial steel reinforcement of tires. Fiber combination H4 contains combination of nylon and steel fibers (NF), and finally H5 combination contains glass (GF) and steel fibers. Before samples fire testing standard mechanical tests on standard samples will be performed to get information about compression strength, tension strength and elasticity module of each concrete type. The fire tests will be conducted with Rijkswaterstaat (RWS) fire curve of 2 hours with a peak temperature of 1,350 °C using large panels measuring 1,200 mm x 1,700 mm x 300mm. In addition to testing the samples to fire action there will be measures and test to mechanical action with the aim of optimizing the required amount of reinforcement.