



Fire behaviour of large scale loaded tunnel segment tests for project Rotterdamsebaan, The Netherlands

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Abstract

Assessing the performance of tunnels in fire is becoming increasingly crucial for the overall usability and durability of the structure. One of the most reliable methods for evaluating the presentation of the concrete during fire in tunnels is by testing. In this work, the fire tests performed on the Victory Boogie Woogietunnel, project Rotterdamsebaan (The Hague, the Netherlands) are discussed. The study aims to assess the fire performance of the cut and cover concrete section when subjected to a tunnel fire curve. A series of 6 fire tests were performed on concrete slabs of the size 5,0 m x 2,4 m x 0,4 m when exposed to Rijkswaterstaat (RWS) fire curve for 120 minutes. Based on the work, one of the main conclusions drawn were that it is necessary to test a large-scale specimen to judge the performance of a protection system accurately. Another important conclusion is that the test specimen should have the concrete mixture which accurately represents the tunnel concrete to avoid uncertainty in the fire induced spalling behaviour of concrete.

Keywords: fire; fire protection; Rijkswaterstaat fire curve; fire induced spalling; tunnel.

1 Introduction

Over the last few decades, it has become quite apparent that the impact of fire in a road tunnel should be taken into account during the design phase. This learning has been due to a combination of lessons learnt from past accidents and the stricter safety measures placed by the various authorities [1]. One of the phenomena which governs the behavioural response of concrete tunnels in fire, is spalling. A number of factors govern the phenomena of spalling, such as the strength of concrete, moisture content, type of cement used, size of aggregate, the compressive

stress in the concrete cross-section, among others. However, it is not possible to state with certainty which factors will be governing for a particular tunnel concrete [2]. Another challenge is to determine the extent and intensity of spalling that might occur in a specimen [3]. In the absence of any theoretical model that is validated with fire tests for a diverse data set, it is impossible to determine the nature of spalling and apply to a tunnel project. Hence, fire testing is the more viable and sufficiently conservative method to ascertain the tunnel fire behaviour.

The Victory Boogie Woogietunnel is part of the new road connection called the Rotterdamsebaan