

Strain Gauge Measurements during the Assembly of the Diabolo Tunnel

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Summary

The Diabolo-project aims to improve the northern railway connectivity of Brussels Airport by 2012. As an important part of this project, a 1084 m long twin tube tunnel was shield driven below the airport runways and taxi-lanes using the mixshield method. During construction of both tunnel shafts, measurements have been carried out at several cross-sections of the tunnel lining. Each monitored ring was equipped with several strain gauges, distributed across the ring perimeter. The practical implementation of the strain gauges and measurement apparatus is explained and the first preliminary results of the completed measurements are presented. Finally a comparison will be made between the strain gauge measurements and extensive ovalisation measurements carried out at identical cross-sections.

Keywords: bored tunnel; strain gauge measurements; precast concrete segments; monitoring; ovalisation.

1. Introduction

Since many years, various theoretical models are used to design bored tunnels. However, since very few measurement results of actual tunnel lining behaviour are available, estimating the accuracy of the theoretical model output in comparison with the actual in situ behaviour remains very difficult.

Some years ago, Belgian authorities decided to improve the railway connection to Brussels Airport, resulting in the Diabolo project, which includes the boring of a 1084 m long twin tunnel. Since most of the road and rail tunnels in Belgium are built using various cut-and-cover methods, this is one of the few bored tunnel projects. Therefore the start of the Diabolo works has been an excellent opportunity to accompany the boring process with an experimental monitoring program. During construction of both tunnel shafts, strain gauge measurements and extensive ovalisation measurements were carried out at several cross-sections of the tunnel lining. The obtained monitoring data aim to be of important use in the validation of the theoretical models and the enhancement of the experience with and the specific knowledge of large-diameter shield tunnelling in soft soil.

2. Diabolo Project

2.1 General Outline

Brussels Airport is located at less than 8 km from the city centre, thus offering easy connections to all passengers travelling to the various activities at the heart of Europe. However, this short distance to the city causes many problems for reaching the airport from the North side, especially by road congestion. As for public transportation, the airport is easily reached by train, but not for passengers travelling from the North of the country, since the airport connections necessarily go via one of the Brussels stations. This situation has inspired authorities to improve the railway and road connection