



New Metro Infrastructures Projects: “From design to long-term reliable operation”

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Abstract

Over the last ten years, a significant number of new underground metro infrastructures projects have been initiated worldwide. Most of these huge, strategic and costly projects are located into fast developing or dense urban areas, facing thus important challenges: interactions with existing buildings, safety risks for the population, validation of innovative construction processes, environmental issues and long-term serviceability. This paper aims to illustrate some of innovative concepts, methods and assessment devices benefit recent projects in addressing some of these important issues.

Keywords: new metro infrastructures projects, intrinsic sensitivity, vulnerability, optical-fibres sensors, steel-fibre reinforced concrete, semi-automatic assessment devices.

1 Introduction

New metro-infrastructure projects contribute worldwide to long-term economic development. These projects require huge long-term investments and insert into almost virgin environments as well as in dense constructed and populated areas. In any case, whether in project, construction or commercial operation phases, assessment of modifications on existing environment and of civil assets compliancy with long-term operation requirements is of essential importance. The achievement of these critical challenges often faces several difficulties: politically and financially-driven schedules, construction issues including the use of innovative methods and materials, and short imposed time windows for maintenance actions.

The three real cases presented here illustrate the way we achieved these challenges at every phase of metro infrastructure projects: design, construction and long-term operation phases.

Firstly, in the frame of Grand Paris Express South Red Line construction project, we present the methods and some results for intrinsic sensitivity and vulnerability assessments of existing

constructions to the movements and vibrations generated by tunnelling works.

Secondly, regarding demonstration of reliability and durability of innovative construction materials, we present a specific optical-fibre sensor monitoring system designed, tested and implemented into steel-fibre reinforced concrete tunnel segments used for the construction of the northern extension of the metro line 14 in Paris area.

The third illustration concerns the periodical assessment of infrastructures' condition, for which comprehensive, objective and reproducible data are required to ensure users' safety, continuous operation and durable serviceability. Innovative semi-automatic assessment devices, which adapt to maintenance constraints and integrate recent developments in imagery and data-process domains are now able to achieve these issues. Benefits of these new devices, in terms of on-site efficiency as well as of data quality, are illustrated with recent assessment results on 11 km-long metro tunnels and a on a 700 m-deep ventilation shaft located in a road tunnel under the Alps.