

Chapter 5

State-of-the-art review on the time-dependent behaviour of composite steel-concrete columns

Yue Geng¹, Gianluca Ranzi², Yu-Yin Wang¹, Raymond Ian Gilbert², Sumei Zhang¹

¹ China, ² Australia

This chapter presents a state-of-the-art review of the time-dependent behaviour of composite columns. The first part of the chapter outlines the available typologies and advantages of composite columns. This is followed by an overview of the time-dependent response of concrete (specific to composite columns) and an introduction to concrete confinement. The main part of the chapter is devoted to the state-of-the-art review on how concrete time effects influence the long-term and ultimate behaviour of concrete-filled steel tube (CFST) columns, and on the combined effects produced by sustained loading and chloride corrosion on CFST columns. The review then deals with the long-term behaviour of concrete-filled double skin tube (CFDST) and encased composite columns. The final parts of the chapter provide a review of the time-dependent differential axial shortening (DAS) in vertical components of multi-storey buildings and on the long-term response of arch bridges.

5.1 Introduction

Composite steel-concrete columns represent an efficient structural typology in which steel and concrete components can be combined in different arrangements depending on their geometry and relative positioning, as illustrated for selected cases in Fig. 5.1.

The first type of composite column adopted in construction consisted of the fully concrete-encased steel section depicted in Fig. 5.1a and this was specified for its ability to enhance the performance of the steel section in terms of structural stiffness and fire protection. With the use of the partially concrete-encased steel column of Fig. 5.1b, it was possible to reduce the concrete volume and the amount of formwork being specified for the casting operations.

In the case of a concrete-filled steel tube (CFST) column, the steel section acts as permanent formwork during concrete casting and the member becomes composite once the