

Review

Chanakya Arya's fourth edition of *Design of Structural Elements* provides an introduction to concrete, steel, timber, masonry and composites, but this update seems to omit context around the structural elements, writes **Chris O'Regan**.

Design of Structural Elements (4th ed.)

Author: Chanakya Arya
Publisher: CRC Press
Price: £42.99
ISBN: 978-1-032-07631-7

OMISSIONS. THAT IS THE FIRST WORD THAT comes to mind when reading the fourth edition of Chanakya Arya's *Design of Structural Elements*. It's a text that attempts to describe the intricacies of the design of elements that are typically found in a building's structure, all while not sufficiently addressing the bigger picture. No person is an island, as it is commonly asserted, but the same can be said for elements in a structure. Yet here we have a text that implies otherwise.

The first chapter opens with an attempt to describe the philosophy of structural design. Arya assumes that by declaring it to be 'the' philosophy, the following text within it is definitive. The substantial amount of research and technical guidance published in *The Structural Engineer* since its inception on this very subject is evidence against that assertion. Nevertheless, an attempt is made to summarise the overarching concept of the design of structures, and there is a significant component that is directed at sustainability and how that is a core criterion for the design of building structures. This is most welcome to see, and I applaud Arya for including it.

We then head on to the second chapter, titled 'Basic Technical and Structural Concepts', which is an interesting inclusion in a book that is ostensibly about the design of structural elements, not their analysis. This chapter detracts from the core purpose of the text, as it delves into relatively rudimentary concepts of structural analysis, a subject that is covered in far greater detail in other specialist texts. I can see the argument for its inclusion with respect to context, but if *Design of Structural Elements* is on that subject, why is analysis included within it? There is an omission within this chapter concerning how it describes imposed loads and their application. No mention was made on how these can be reduced when designing a floor support beam. There is also no reference made to equivalent horizontal forces or thermal effects, both of which are key sources of load generation.

The third chapter covers the design of reinforced concrete elements in accordance with Eurocode 2. Almost every type of element is covered, except for a pile cap. In fact, the foundation component of this chapter is the weakest as it fails to sufficiently address the need to fully understand the interaction between soil and substructure. The design of other elements described is, however, generally comprehensive. There is even a lengthy discussion

on the adoption of strut-and-tie methods for determining shear resistance in concrete beams, for example. Although, I would note that there is no guidance offered on the design of flat slabs, which are a common form of construction.

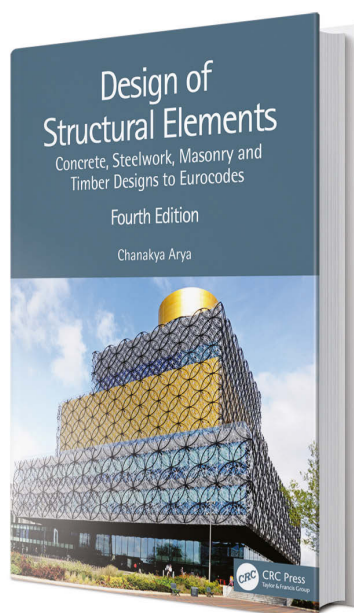
The topic of the fourth chapter is structural steelwork, designed in accordance with Eurocodes 3 and 4. This text does refer to framing action and how it can impact the design of elements, but does not allude to the complexities of using sway frames with respect to non-linear second-order effects. I'm not asking for this to be described in detail here, just some direction given to their existence. Speaking of omissions, no mention is made of steel subgrades, which structural engineers are required to specify in their design output. I do recognise the presence of composite beam design guidance though, which is well put together.

Chapters 5 and 6 cover the design of masonry and timber respectively. Like the other chapters, they tend to focus on the elements without giving sufficient reference to the structural systems they are placed within. Examples of this include no reference to movement joints within masonry and no attention

is paid to timber connections and the protection against fire for such elements.

Noting that this is not Arya's first rodeo, for this is the fourth edition of a text first penned in 1994, it surprises me that it fails to take a more objective look at the approach to design promoted within it. For while I applaud the drive to offer guidance on design of structural elements, it is vital that said assistance is sufficiently comprehensive for it to be of worth. While much of *Design of Structural Elements* is useful and does go into some detail, that is hampered by the lack of context within which it is given.

“
IF DESIGN OF STRUCTURAL ELEMENTS IS ON THAT SUBJECT, WHY IS ANALYSIS INCLUDED WITHIN IT?”



Chris O'Regan
 BEng(Hons), CEng, FStructE, FICE

Chris is an Associate Director at Mason Navarro Pledge and has been working in the field of structural engineering for over 35 years. He has a broad experience in designing building structures for a large variety of forms ranging from medium-rise residential developments through to stadia and everything in between. He is technical author of the second edition of the IStructE's *Structural use of glass in buildings*, and of the Technical Guidance Notes series.