摘要

關鍵詞：鋼結構、設計、規範、耐震

一、研究緣起

國內建築鋼結構設計規範始於民國 88 年(1999)，根據「建築技術規則」的法源制定，規範名稱為「鋼構造建築物鋼結構設計技術規範」，分為「鋼結構容許應力設計法規範及解說」與「鋼結構極限設計法規範及解說」兩冊。此規範於民國 96 年(2007)修訂，並沿用至今，已逾 14 年。國內鋼結構設計規範的訂定，主要以美國鋼結構協會(AISC)出版之設計規範為藍本。現行鋼結構設計規範的容許應力設計法與極限設計法，分別依據 AISC 於 1989 年的容許應力設計法(Allowable Stress Design, ASD)與 1999 年的載重與強度因子設計法(Load and Resistance Factor Design, LRFD)修訂，相對美國現行 2016 年版 AISC 360(鋼結構建築規範)與 AISC 341(鋼結構建築耐震規定)已相距 17 年，且 AISC 360 與 341 的新修訂版本已近尾聲，預計於 2022 年出版，屆時更將差異超過 20 年。在此期間，較先進的鋼結構設計觀念、方法、系統等已被研發，並納入 AISC 360 與 341 規範中。因此，本研究針對國內鋼結構設計規範的修訂進行探討與研擬，以納入先進的鋼結構設計技術。

二、研究方法與過程

為延續現行規範的一致性，本次國內鋼結構設計規範修訂是以 AISC 360 與 341 之 2016 年版為基礎，並參考國內工程實務與研究成果等修訂之。本次鋼結構設計規範修訂研擬研究，將現行規範的容許應力設計法與極限設計法兩冊合併為一冊。將容許強度設計法(Allowable Strength Design, 仍稱為 ASD)取代現行規範的容許應力設計法，並以構材極限強度與機率式(probability-based)載重準則結合的 LRFD 設計法為修訂基準，使容許強度設計法與 LRFD 設計法具相同安全等級的設計結果。為提升鋼結構建築的耐震設計有效性，本修訂版本在第十四章耐震設計中導入材料的預期實際強度概念，做為構材或元件的強度容量設計基準，以期確保建築結構的實際受震行為與設計假設條件儘可能一致，驅使耐震消能元件的韌性能如預期地發展。除此之外，本修訂草案也新增國內工程實務需求，或具高效率耐震性能的耐震系統，包括：懸臂柱、挫屈束制斜撐(BRB)與鋼板剪力牆(SPSW)等耐震結構系統，及相關耐震設計規定。在本修訂版本研擬研究中，也增加耐震構材、元件、接合與構架的驗證試驗規定章節，以提出驗證試驗之方法、程序與合格標準有一致的規範；也可做為設計者驗證所設計或開發者所研發之耐震構材、元件、接合或構架的有效性。有關中空結構斷面(hollow structural section, HSS)鋼管的接

合規定也大幅增列於本修訂版本中，此部分有助於國內發展離岸風電支撐結構的本土化設計與施工技術。

本鋼結構設計規範修訂草案研擬工作，是集合國內具有學識專精且志願付出參與的技師、學者與研究人員等，組成「鋼結構設計規範修訂草案研擬」委員會執行之，針對本草案研究是以分章且逐條討論的程序進行。各委員奉獻自己的閒暇時間研擬各章節內容，並共舉行超過 30 次逐條討論會議，以求條文制定的嚴謹、規範的完整性、國內的適用性、前後的一致性等基本原則。在委員會各參與委員的無私奉獻與辛勤工作，本修訂草案得以完成，並往修訂國家鋼結構設計規範的方向邁進。

三、主要建議事項

根據本研究之內容，提出下列具體的建議。以下分別從短期可行建議與中長期性建議加以說明。

短期可行建議：進行「新版鋼結構設計技術規範中因應我國工程特性之相關參數研究」。

主辦機關：內政部建築研究所。

協辦機關：中華民國鋼結構協會、國家地震工程研究中心。

本研究計畫所完成之「鋼構造建築物鋼結構設計技術規範」修訂草案中，由於部分參數是參照美國 AISC 規範資料擬定，該參數尚應再針對我國載重規定與載重情況、鋼料規定與施工方式的不同作探討，以使新版規範後續在使用時，能更符合我國的其他規定與工程環境。

中長期可行建議：進行「鋼構造建築物鋼結構設計技術規範之修訂草案」審查。

主辦機關：內政部營建署。

協辦機關：內政部建築研究所、中華民國鋼結構協會、國家地震工程研究中心。

本研究計畫所完成之「鋼構造建築物鋼結構設計技術規範」修訂草案，由於與民國 96 年頒布的規範版本相比，變動幅度較大，建議將修訂完成之新版本草案且經本鋼結構設計規範修訂草案研擬之委員會研討確認後，將其草案提送內政部營建署審查，以更新現有「鋼構造建築物鋼結構設計技術規範」。

中長期建議：舉辦「鋼構造建築物鋼結構設計技術規範修訂草案講習活動」。

主辦機關：內政部營建署。

協辦機關：內政部建築研究所、中華民國鋼結構協會、國家地震工程研究中心。

本協會後續將與內政部建築研究所及國家地震工程研究中心審慎檢視各界反映意見，並妥適納入修訂草案內容，及持續協助營建署辦理研究成果推廣講習。

Abstract

Keywords: steel structure, design, specification, seismic

The domestic structural steel building design specification began in 1999. According to the legal source of “Building Technical Regulations”, the name of specification is “Design and Technique Specifications of Steel Structures for Buildings”, which is divided into “Specification and Commentary of Allowable Stress Design Method for Steel Structures” and “Specification and Commentary of Ultimate Strength Design Method for Steel Structures”. This specification was revised in 2007 and has been used for more than 14 years. The establishment of domestic steel structure design specification is mainly based on the design specification published by the American Institute of Steel Construction (AISC). The allowable stress design method and the ultimate strength design method of the current steel structure design specifications are revised according to the Allowable Stress Design (ASD) method of AISC in 1989 and the Load and Resistance Factor Design (LRFD) method of AISC in 1999. Compared with the current 2016 version of AISC 360 (Specification for Structural Steel Buildings) and AISC 341 (Seismic Provisions for Structural Steel Buildings), it has been 17 years away. Moreover, the new revised version of AISC 360 and 341 are coming to an end, and it is expected to be published in 2022. By then, the difference will be more than 20 years. During this period, more advanced steel structure design concepts, methods, and systems have been developed and incorporated into AISC 360 and 341 specifications. Therefore, this resarech will discuss and study the revision of domestic steel structure design specification in order to incorporate advanced steel structure design technology.

In order to maintain the consistency of the current specifications, this revision of the domestic steel structure design specification is based on the 2016 version of AISC 360 and 341, and revised with reference to domestic engineering practices and research results. In this study, the two volumes of the allowable stress design method and the limit design method of the current specification were combined into one volume. The allowable strength design method will replace the allowable stress design method of the current specification. And based on the LRFD design method combining the ultimate strength of the member with the probability-based load criterion as the revised standard, the allowable strength design method and the LRFD design method have the same safety level design results. In order to improve the effectiveness of the seismic design of structural steel buildings, this revised edition introduces the expected actual strength concept of materials in Seismic Design of Chapter 14 as the design basis for the strength capacity of the members or elements. And ensure that the actual seismic behavior of the building structure is as consistent as possible with the design assumptions, and drive the ductility of the seismic energy dissipation components to develop as expected. In addition, this revised draft also adds domestic engineering practical requirements, or seismic systems with high-efficiency

seismic performance, including: seismic structural systems such as cantilever columns, buckling-restrained braced (BRB), and special plate shear walls, and related seismic design regulations. In the research and development of this revised edition, the chapters on the verification test regulations for seismic structures, components, connections and frames are also added to propose that the verification test methods and procedures are consistent with the qualification standards. It can also be used to verify the effectiveness of seismic structures, components, joints or frames designed or developed by designers or developers. The requirements for the connecting of steel hollow structural section (HSS) pipes have also been significantly added to this revised edition. This part is helpful for the development of localized design and construction technology for offshore wind power supporting structures in Taiwan.

The draft revision work of this steel structure design specification is a collection of domestic technicians, scholars and researchers who have knowledge and expertise and volunteer participation to form the "Revision Draft of Steel Structure Design Specification" committee for execution. The research on this draft is conducted in a chapter-by-chapter and article-by-article discussion procedure. Each committee member devotes his free time to study the content of each chapter, and had held more than 30 article-by-article discussion meetings in order to seek basic principles such as rigorous formulation of the provisions, completeness of specifications, domestic applicability, and consistency. With the selfless dedication and hard work of the participating members of the committee, this revised draft was completed and moved towards the revision of the national steel structure design specification.