

鋼筋混凝土柱梁偏心接合之耐震抗剪強度檢討

Review and evaluation of reinforced concrete eccentric beam-to-column connections

主管單位：內政部建築研究所

李宏仁¹

林克強²

紀凱甯²

林明志¹

Lee, Hung-Jen¹

Lin, Ker-Chun²

Chi, Kai-Ning²

Lin, Ming-Jhih¹

¹ 國立雲林科技大學營建工程系

² 國家實驗研究院國家地震工程研究中心

摘要

鋼筋混凝土造建築物之耐震設計攸關國人生命財產安全，其結構設計及細部配筋應依循部頒混凝土結構設計規範。國人基於建築外觀及空間利用之考量，建築物柱斷面時常設計為長方形，且梁中心線時常不能通過柱中心線形成柱梁偏心接合，偏心梁對接頭區會造成意外扭矩，減損接頭耐震抗剪強度，現行設計規範針對偏心梁連續貫穿接頭之情況，依偏心程度折減其接頭抗剪強度，惟此折減公式係根據偏心梁連續貫穿接頭之實驗歸納而來，然而實務上常見柱斷面長寬比值達 2.0 甚至 2.5，梁柱不但是偏心接合，接頭兩側所接之梁甚至不連續，梁主筋分別中斷錨定於接頭內，形成錯位偏心梁柱接頭，此類偏心梁柱接頭之耐震行為複雜，亦不在現行設計規範所考慮的情況，因為錯位偏心梁柱接頭剪力強度如何計算未有明確的規範或依據，造成工程師認知不一致，相同的梁柱接頭剪力強度計算結果可能相差一倍以上，亟待釐清檢討改善，避免設計錯誤。

國內外絕大多數的梁柱接頭實驗為無偏心之梁柱接合，偏心梁柱接頭之實驗成果非常稀少，而且幾乎都是梁連續貫穿接頭的情況，我國建築工程常用長方形柱斷面且兩長邊各接一偏心梁且梁不連續，形成錯位偏心梁柱接合，此類接頭之實驗數據相當罕見，但實務上確有需要。現行混凝土結構設計規範和新版規範草案並未涵蓋此類偏心接頭，為確保建築結構安全，本研究檢討此類接頭之耐震抗剪強度，藉由大型結構實驗探討鋼筋混凝土柱接不同偏心距之梁，其接頭剪力強度之衰減程度，補足過往實驗經驗不足之處，俾利規範審議時參考引用，讓設計及施工單位有所依循，確保建築結構耐震性能及國人生命財產安全。

關鍵詞：梁柱接頭、剪力、耐震設計、規範

Abstract

The life and property safety of reinforced concrete buildings depends on the building codes and requirements given by the building officials. Due to architectural reasons, rectangular columns and eccentric beam-to-column connections are commonly used. Eccentric beams may introduce additional torsions on the joints and reduce the joint capacity under seismic reversals. Current building codes use effective joint width to accounting the effects of column's aspect

ratio and joint eccentricity. However, the provisions of effective joint width are based on the experiments of beam-column connections having eccentric beams continuously extended through the joint. Unfortunately, two eccentric beams fanning into the opposite faces of the joint with unequal eccentricities are used very often, where the eccentric beams are discontinuous and terminated at the joint. The complicated seismic behavior of such beam-column connections with offset eccentric beams are not considered in the current building codes. Because the lack of provisions for determining the shear strength of beam-column joints with offset eccentric beams, code users and engineers may could not correctly estimate such joint shear strength. Review and evaluation of such eccentric beam-to-column connections are needed.

Most of the existing connection experiments are beam-column joints without eccentricity. Eccentric beam-column connections are relatively rare, and all of available data having eccentric beams continuously extended through the joint. Taiwanese buildings have many rectangular columns and offset beam-to-column connections, which are not considered in the current building codes section 15.6.3. To promote the life and property safety of building structures, this project will test and evaluate the shear strength and degradation of beam-column connections with varying joint eccentricities. According to this experimental investigation, it is recommended to take the smaller value of effective joint widths for oppoite faces of a joint with eccentric beams.

Keywords : beam-column joint, shear, seismic design, code