

鋼梁與包覆箱型鋼柱接合之梁柱接頭耐震試驗

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摘要

本研究進行兩組大尺寸梁柱接頭之反復載重試驗以探討其耐震性能。本研究之試體採用鋼梁與「受鋼筋混凝土包覆之箱型鋼柱」（簡稱包覆箱型鋼柱或 SRC 柱）接合之梁柱接頭。此種鋼梁與 SRC 柱接合之構造的主要特點，在於利用 SRC 柱之勁度、防火與抗壓強度方面的長處，又可以發揮鋼梁在韌性與施工便捷方面之優點。

本研究之試體均符合強柱弱梁之原則且梁柱接頭區之標稱剪力強度均大於該區之需求剪力強度，試體之斷面配置均符合我國 SRC 設計規範之要求。實驗結果顯示，由於 SRC 柱內之箱型鋼管斷面在 X 與 Y 向各有兩片腹板，故可以提供梁柱接頭區充分的剪力強度，並可抑制接頭區的剪力變形，使接頭區之混凝土保持良好狀態，並無明顯開裂之情形，進而確保插入 SRC 柱的鋼梁受到接頭區之鋼筋混凝土有效的束制，使得鋼梁的塑性鉸可以遠離銲道，最終在 SRC 柱之混凝土面外約 15 公分處發展出穩定且充分的塑性變形。換言之，SRC 柱接頭區的鋼筋混凝土具有保護鋼骨梁柱接頭銲道的功能，該區的鋼筋混凝土成功的將鋼梁的塑性鉸逼離銲道，使鋼梁在 SRC 柱混凝土面外形成良好的塑性鉸。

本研究之梁柱接頭試體在反復載重作用下，可以發展出穩定且飽滿的遲滯迴圈（Hysteretic Loop）。兩組試體之鋼梁「塑性轉角」（Plastic Rotation Angle）達到 5.4 % 和 6.0 % 弧度，梁柱接頭之「層間變位角」（Interstory Drift Angle）達到 6.2 % 與 6.7 % 弧度，顯示此兩組梁柱接頭均具有優良的塑性變形能力。本研究依據有限的試驗結果初步證實，在適當設計下，此種型式的梁柱接頭將可以發揮良好的耐震性能。

關鍵字：鋼梁、包覆箱型鋼柱、SRC 柱、梁柱接頭、反復載重試驗、鋼梁塑性鉸、層間變位角、剪力釘、接頭區剪力強度、接頭區混凝土束制、耐震性能

SEISMIC BEHAVIOR OF STEEL BEAM TO STEEL REINFORCED CONCRETE (SRC) COLUMN CONNECTIONS

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Abstract

The objective of this study is to investigate the seismic behavior of steel beam-to-SRC (Steel Reinforced Concrete) column connections. The reason of using the SRC column is to take its advantages of larger stiffness and compressive strength. Two full-size specimens were investigated through cyclic loading test. Both specimens were designed to meet the strong-column weak-beam requirement. The test results showed that the steel beams of all specimens developed excellent plastic rotation capacity. Satisfactory interstory drift angle up to 6% radians were observed from the tests. The test results also indicated that the reinforced concrete in the connection zone provided “effective constraint” to the steel beam which was embedded in the SRC column. This constraint had helped the steel beam to develop satisfactory plastic hinge right out of the SRC column face, and protected the welded joint from premature failure.

Key Words: Steel Beam, SRC Column, Connection, Full-size Specimen, Cyclic Loading Test, Plastic Hinge, Seismic Behavior.