When the RC frame buildings are subjected to earthquake load, the possible brittleness will be concentrated either in beams or the beam-column joints. The failure of RC beam-column joints is due to concrete cracking and yielding of steel bars, which affects by the detailing of transverse links in the joints and anchorage of beam and column reinforcement etc. (Scott 1992 and Hegger 2003). To avoid the sudden degradation of the strength and brittle failure of the frame structure, it is mainly necessary to maintain the integrity of the beam-column joint, because the failure of the RC joint will lead to the instability of the structure.

Therefore, a further understanding of the seismic performance of RC beam-column joints with non-seismically design details is indispensable to evaluate the overall structural response of the existing buildings without seismic effect considerations in detail. Retrofitting or strengthening should be made to enhance the shear strength and improve the seismic performance, which may finally lead to modifications in the analysis of the current design codes.

In this paper, four RC exterior beam-column joints were designed according to the Hong Kong Code of Practice (HKSUC 2013), fabricated, and tested under reversed cyclic-load. The primary intention of this project is to study the effects of the stirrup ratio in joints and the beam-column depth ratio on the seismic behaviour of non-seismic detailed RC exterior beam-column joints subjected to simulated seismic loading. Then, by comparing the experimental results with the predicted values of three seismic and two pre-seismic design codes, the effectiveness of the current codes for predicting the shear strength of beam-column joints with non-seismic detailed is evaluated.

2. EXPERIMENTAL PROGRAMME

2.1 Specimens

Four RC exterior beam-column joints designed according to the Hong Kong Code of Practice for Structural Use of Concrete are constructed and tested. Each having a beam of 200 mm wide framing into the column of 200 mm × 200 mm cross-section. Each column in all specimen is mainly reinforced with 4T16, but the longitudinal reinforcement of the beam is different. One beam with 200 mm × 200 mm cross-section is reinforced with an equal amount of steel bars of 3T12 at both top and bottom sides of the beam section, nevertheless, the steel bars of 3T12 in the other three beam cross-section of 200 mm × 400 mm were replaced by 3T16. Two specimens have no transverse link in beam-column joints, and the other two have 1T10 and 2T10 shear links in joint core respectively. The details of reinforcement and geometry of the specimens are shown in Fig. 1.

Table 1 shows the compressive strength of the concrete of the specimens, and the yield strength of the reinforcement, f_y, is 500 MPa. The first part of the label of the specimen in Table 1 and Fig. 1, HKOL, stands for design to HK Code with the opposed arrangement of the “L” shaped anchorage of beam reinforcement. The specimen series is followed by numbers, which represent the depth of beam (200 mm and 400 mm), and the shear links in the joint core (1T10 and 2T10).

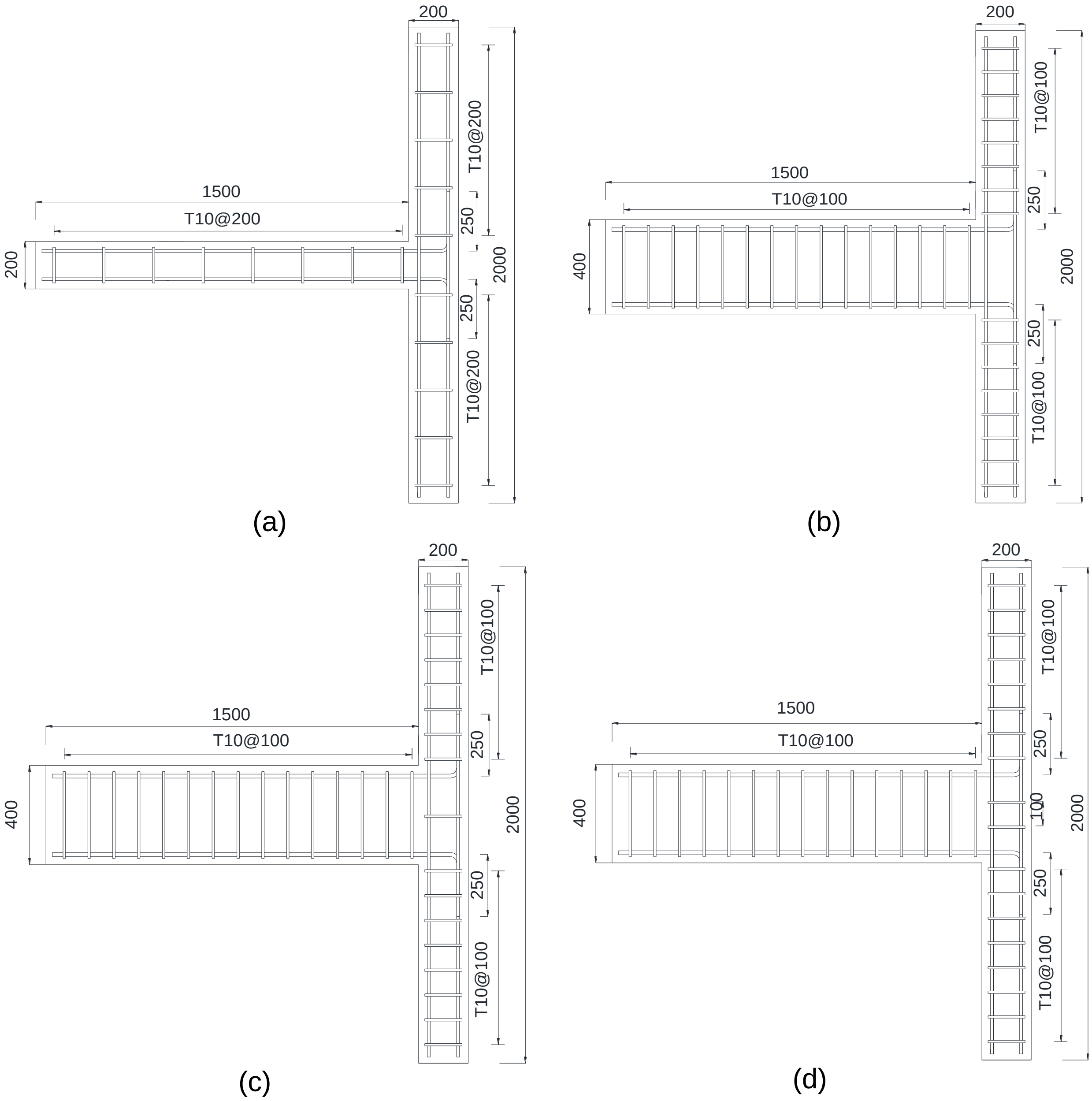

Fig. 1 Details of reinforcement and geometry of the specimens: (a) specimen HKOL-200; (b) specimen HKOL-400; (c) specimen HKOL-400-L; (d) specimen HKOL-400-LL (dimensions in mm)

Table 1 Material properties

Specimen	HKOL-200	HKOL-400	HKOL-400-L	HKOL-400-LL
Concrete compressive strength, f_{cu} (f'_c): MPa	50.1(40.1)	43.1(34.5)	38.9(31.1)	23.3(18.64)