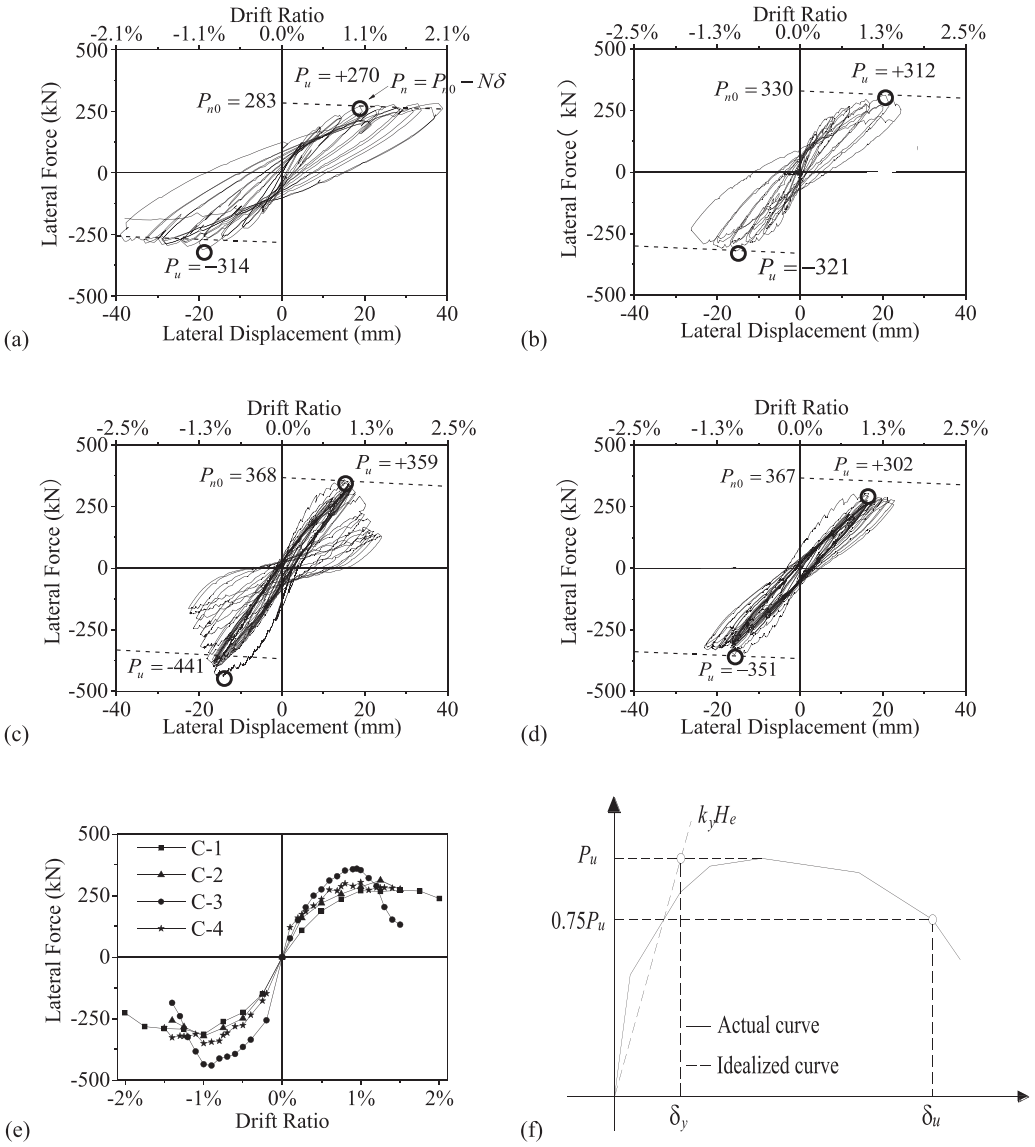

Fig. 4. Lateral load-drift relationship of specimens.

3. Test Results

3.1. Lateral Load-Drift Ratio Relationship

Fig. 4 shows the lateral load-drift ratio (P-δ) relationships of the column specimens. The lateral drift ratio was calculated by the lateral drift Δ at the loading point over the column height H_c (= 1900 mm for C-1, and 1600 mm for C-2 to C-4). Table 2 lists the peak strength P_u, yield drift ratio δ_y, ultimate drift ratio δ_u, and ductility ratio μ of the specimens. According to Park [15], the yield drift ratio δ_y was defined as $P_u/(K_y H_c)$ (refer to Fig. 4(f)). The yield stiffness K_y was defined as the slope corresponding to $0.75P_u$. The ultimate drift ratio δ_u was defined as the post-peak drift ratio corresponding to $0.75P_u$. Fig. 5 shows the damage of the specimens at the end of the tests.

Figs. 4(a) and 5(a) show the test result of specimen C-1. When the lateral force reached 187 kN at $\delta = 0.5\%$, several flexural cracks occurred at the both ends of the specimen. The longitudinal bars yielded at $\delta = 0.75\%$, and the yield load-carrying capacity P_y reached 235 kN and − 262 kN. After the peak strength P_u reached 270 kN and − 314 kN at $\delta = 1.0\%$, hoop bars yielded, and diagonal cracks extended to the center of the specimen. Though spalling of the cover concrete occurred at $\delta = 1.5\%$, the load-carrying capacity was not significantly decreased. At the first cycle of $\delta = 2.0\%$, diagonal crack width increased to 3.8 mm. Ultimately, C-1 failed at the second cycle of

Table 2
Summary of cyclic loading test results.

Specimens	Peak strength P_u (kN)		Yield drift ratio δ_y (%)		Maximum drift ratio δ_u (%)		Nominal strength P_{no} (kN)	Yield stiffness K_y (kN/mm)		Ductility μ (= δ_u / δ_y)	
C-1	+ 270	− 314	+ 0.72	− 0.76	+ 1.93	− 2.01	283	19.9(+)	21.8(-)	2.70(+)	2.65(-)
C− 2	+ 312	− 321	+ 0.69	− 0.62	+ 1.50	− 1.53	330	28.2(+)	32.5(-)	2.17(+)	2.48(-)
C− 3	+ 359	− 441	+ 0.61	− 0.51	+ 1.22	− 1.20	368	37.0(+)	54.5(-)	2.01(+)	2.37(-)
C− 4	+ 302	− 351	+ 0.59	− 0.57	+ 1.50	− 1.54	367	32.2(+)	38.6(-)	2.56(+)	2.71(-)