

# Beams connected to concrete-filled tubular steel columns

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# Beams Connected to Concrete-Filled Tubular Steel Columns

Poutres combinées à des piliers tubulaires  
en acier remplis de béton

Stahlbetonträger auf betongefüllten Stahlrohrstützen

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## 1. INTRODUCTION

When SRC beams are used to concrete-filled steel tubular columns, the reinforcements of beams are arranged through the flanges of tubular columns, but the concrete of beams is discontinued due to the steel tube. However, since the shear strength of the steel parts of SRC beams of regular proportion is sometimes redundant, there is a possibility that the shear force of RC parts of beams may be transferred to the columns through the steel. In other words, the steel parts of beams can be considered shear connectors.

Through the cyclic loading test, in which the steel's ratio to the SRC beams and the shear spans are applied as parameters, this paper shall study the characteristics of stiffness, strength and hysteresis behavior of beams. This paper shall also investigate the possibility of the mixed structure with SRC beams and concrete-filled tubular steel columns.

## 2. OUTLINE OF TEST

The specimens are T shaped frames which are composed of a SRC beam and a concrete-filled steel tubular column. Tubular column to beam connection is internal diaphragm type. The bending strength ratios of the steel parts to beams are established at 0.7,

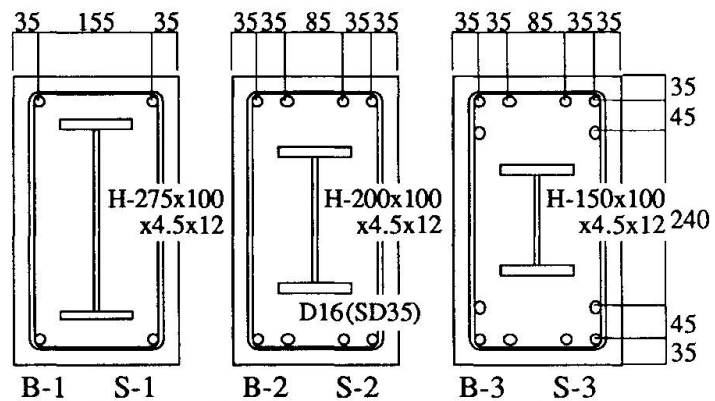


Fig. 1 Cross Section of Beams (unit: mm)

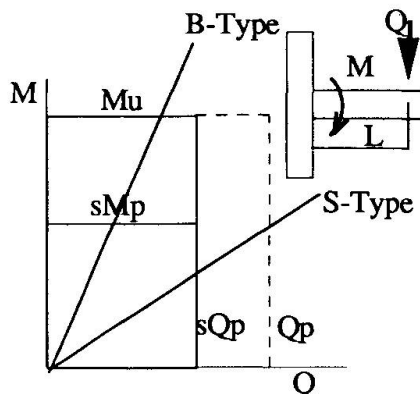


Fig. 2 M-Q Strength-correlation

TABLE 1 List of Specimens

	B-1	S-1	B-2	S-2	B-3	S-3
L (mm)	1200	600	1600	600	2000	600
sQp (kN)	276	277	194	193	138	138
sQMp (kN)	169	338	85	224	47	159
rQp (kN)	163	220	163	220	156	210
rQM <sub>y</sub> (kN)	42	84	64	169	72	230
Qp (kN)	439	497	357	413	294	349
QM <sub>u</sub> (kN)	211	422	149	393	119	389
Q <sub>u</sub> (kN)	211	362	149	362	119	349

$$QM = M*/L, \quad Q_u = \min(sQp, sQMp) + \min(rQp, rQM_u)$$



0.5, and 0.3. There are six specimens, each of which has a shear span established by assuming two types of rupture determined by the strength-correlation between the bending moment and shear force. One type of rupture is considered for a situation in which the bending moment proved to be predominant, and the other is designed for an instance in which the shearing force proved to be predominant (Fig.1,2 and Table 1). Loading system is employed the cantilever beam type method. Cyclic load actions were conducted repeatedly in a deformation control system.

3.RESULTS OF TEST

The testing values for stiffness and ultimate strength of the all SRC beams are very close to the values calculated for the SRC beams with superimposed method (Fig.3,5). The hysteresis behaviors show the characteristics of stable restoring force (Fig.4,6).

4.CONCLUSION

- 1) When the RC parts of the beams are discontinuous due to steel tubes such as SRC beams to concrete-filled steel tubular columns, the shear force which the RC shares can be transferred to the columns because of the friction induced in the compression area of RC parts and the effects caused by the dowel of steel and reinforcement.
- 2) Then, the shear strength of SRC beams can be evaluated independently upon each bending strength, and the bending strength of SRC beams can be evaluated independently upon each shear strength by the superimposed method.

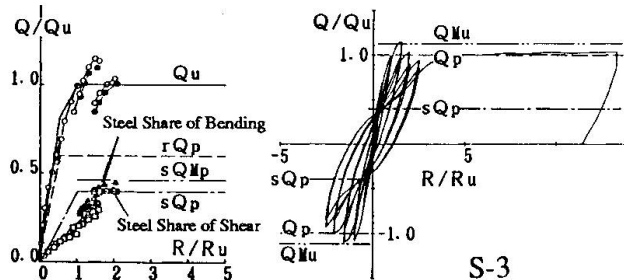
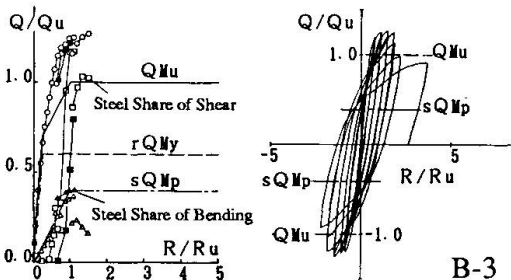
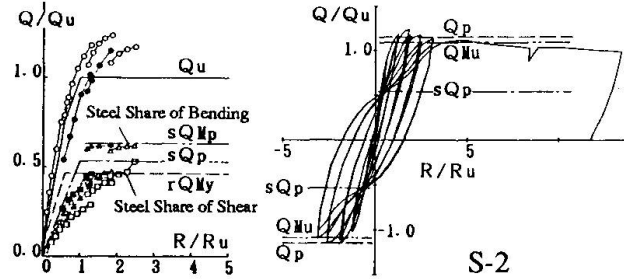
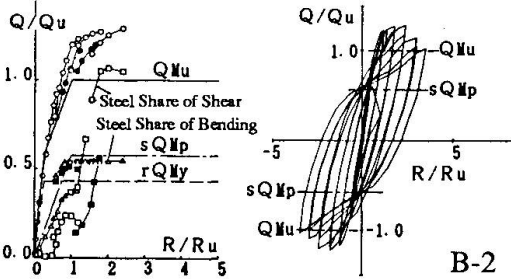
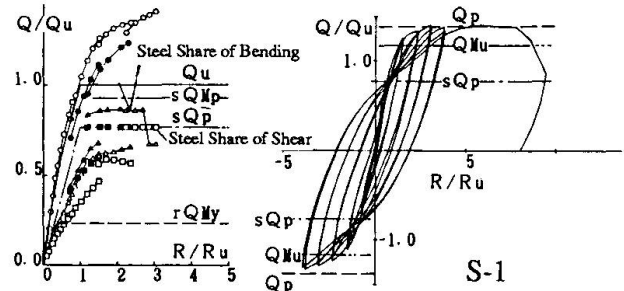
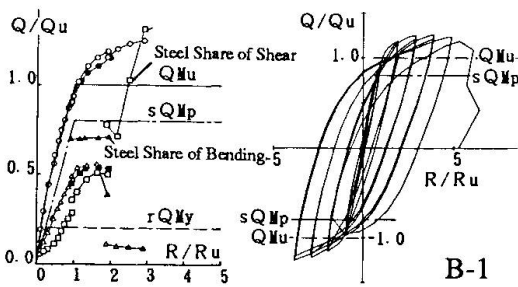


Fig.3 Skeleton Curves (B-Type)

Fig.4 Hysteresis Behavior (B-Type)

Fig.5 Skeleton Curves (S-Type)

Fig.6 Hysteresis Behavior (S-Type)