STTENGTH AND MECHANICAL BEHAVIOR OF BOLTED COLUMN BASE CONNECTION

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1. Introduction

The 1995 Hyogoken-Nanbu (Kobe) Earthquake caused serious damage to the connections in steel buildings, and column base plate connections were no exception. In the column base plate connection, plastification was evidenced only at the anchor bolts, indicating small amount energy dissipation.

A new type of ductile column base is introduced in this research, in which the plastification is expected to develop in the column end and thus enhances the energy dissipation under severe cyclic load. To facilitate the construction of column base, a steel wide flange foundation beam is used instead of a conventional reinforced concrete foundation beam. The beam is connected to the foundation beam with T-stubs using high strength bolts. In the real construction, the foundation beam and column connection will be embedded in concrete.

2. Test program

A total of five large-scale specimens were tested to investigate the strength and deformation capacity of the ductile column base connection. Key structural parameters are the strength ratio of column and foundation beam, effect of concrete. And a column base plate connection was included as baseline specimen. Test specimens are listed in Table 1.

The axial force effect was considered in the design of specimens. With a load of 1.3 times the full-plastic moment of the column in the presence of axial force, the beam and the joint shall remain elastic.

Table 1 Summary of test specimens

Column base type			Specimen	Concrete	Foundation beam
T-stub connection	Interior column	Strong axis	TC	Have	H-350×175×7×11
			TS	None	H-350×175×7×11
		Weak axis	TW	Have	H-350×175×7×11
	Exterior column	Strong axis	L1	Have	H-500×200×10×16
			L2	Have	H-350×175×7×11
Base plate connection			TA		

Each test specimen was placed in the loading frame, as shown in Fig. 1. In the loading, the specimen was subjected to a constant vertical force of 910kN, which was calculated as 0.3 times the yield load. Displacement-controlled horizontal cyclic load was applied quasi-statically.

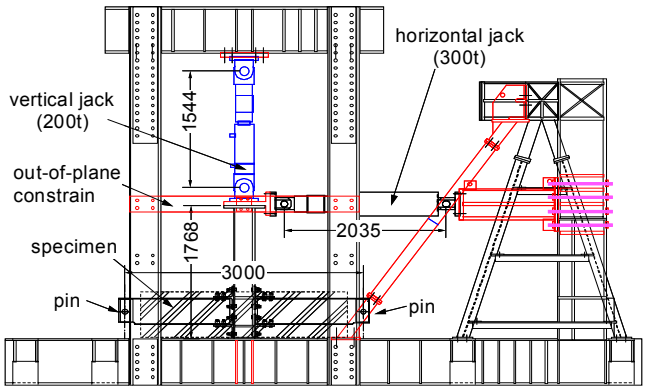

Fig.1 Elevation of the loading system

3. Conclusions

The test results show the bolted column base connection would be a promising connection for the seismic design of ductile steel moment frames. Major findings obtained from the tests are as follows:

(1) The proposed bolted column base connection which is designed to retain in elastic range is effective to obtain large energy dissipation from the inelastic behavior of column member at the base.

(2) Since the rotation of the connection due to the local deformation of the joint is not more than 10% of the total rotation, this connection can be assumed to be a rigid connection in the structural design.

(3) The validity of strength and stiffness estimation presented in this study has been confirmed. These equations are expected to be used in future design.