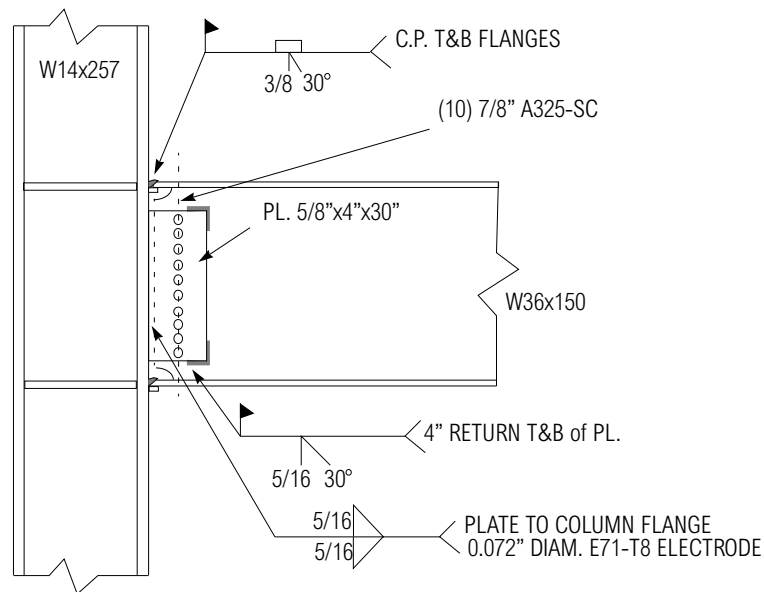


Specimen ID: UCB-PN2  
 Keywords: Pre-Northridge, simulated field welding, column flange fracture, continuity plate yielding, small rotation capacity  
 Test Location: University of California, Berkeley  
 Test Date: February 16, 1995  
 Principal Investigator: Egor P. Popov; with Marcial Blondet, Lev Stepanov, and B. Stojadinovic  
 Related Summaries: 25  
 Reference: "Experimental Investigations of Beam-Column Subassemblages", *Report No. SAC 96-01*, March 1996.  
 Funding Source: FEMA / SAC Joint Venture, Phase I

**CONNECTION DETAIL**



**MATERIAL PROPERTIES AND SPECIMEN DETAILS**

Member	Size	Grade	Yield Stress (ksi)		Ultimate Strength (ksi)	
			mill certs.	coupon tests *	mill certs.	coupon tests *
Beam	W36x150	A572 Gr. 50	62.6	60.6 flange 60.1 web	74.7	68.8 flange 69.7 web
Column	W14x257	A572 Gr. 50	53.5	48.3 flange NA web	72.5	67.8 flange 76.1 web
Welding Procedure Specification	All welds FCAW-SS in conformance with AWS D1.1-94, performed with 0.120" diameter AWS E70T-4 electrodes. Preheat and interpass temperature per Table 4.3. Fillet weld of shear tab to beam web performed with 0.072" diameter AWS E71T-8 electrode.					
Shear tab	5/8"x30"x4" plate with ten 7/8" A325 bolts					
Panel zone	No doubler plates					
Continuity plates	1/2" plates with c.p. weld					
Boundary conditions	Single-sided test, no floor slab, axial load in lower half of column equal to shear in beam, specimen tested in flat position					
Other detailing	5/16" fillet weld upper and lower ends of shear tab					

N.A. = not available

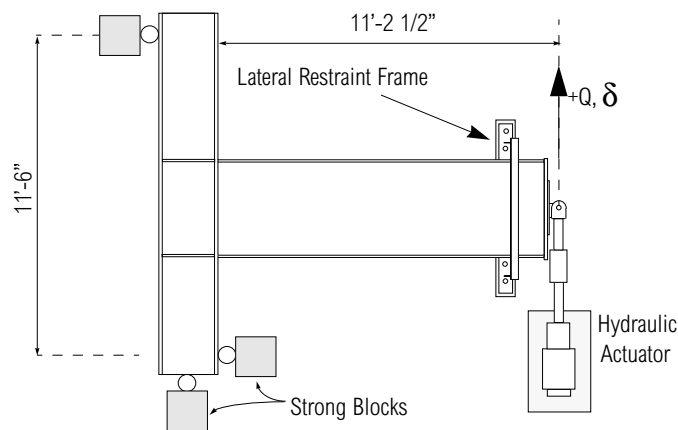
\*Coupon locations per ASTM

## BACKGROUND

The objectives of testing the Pre-Northridge specimens were to replicate in the laboratory the failure modes observed in the field after the Northridge earthquake to develop a better understanding of the failure mechanisms, and to acquire data on the likely deformation characteristics of beam-column connections constructed to industry standards before 1994. The specimen described in this summary was fabricated under controlled conditions by a local commercial steel fabricator to details specified by SAC and the principal investigator. It was intended to be identical to the specimens described in Test Summaries No. 10 and 12. However, Grade 50 beam steel was used in this specimen and Specimen UCB-PN1, instead of the A36 steel which was originally specified. The beam in Specimen UCB-PN3 was fabricated from A36 material. This specimen was also of the same size as the specimens described in Test Summaries No. 7, 8, and 9 that were tested at the University of Texas at Austin. Because each of these were fabricated under controlled conditions, however, it is possible that their quality is superior to typical moment connections fabricated in the field prior to the Northridge earthquake. As such, some field-fabricated moment connections may exhibit less rotation capacity than these test specimens.

The standard SAC/ATC-24 loading history was used in the testing, and the testing was performed quasi-statically. The reference loading displacement ( $\delta_y$ ) for the specimen was specified as 1.00 in.

### TEST SET-UP



### DISPLACEMENT HISTORY AND KEY EXPERIMENTAL OBSERVATIONS

Applied Displacement History	Key Observations of the Test	
	Point	Description
	1	Yielding in the middle of panel zone, slight bolt movement in the shear tab
	2	Fracture of column flange adjacent to beam bottom flange weld
	3	Load carrying capacity reduced to 30% from first displacement cycle to $2\delta_y$ ; significant yielding of lower continuity plate

### DETAILED TEST RESULTS

Quantity (see Introduction for definitions used in EERC tests)		Maxima
Force/Displacement Properties	Peak actuator force (kips):	195
	Beam tip deformation (in.) total/beam only:	1.62/0.81
	Experimental yield displacement (in.):	0.86
Rotation Capacity	Maximum plastic rotation (% radian) total/beam only:	0.34/0.10
	Cumulative plastic rotation (% radian):	NA
Energy Dissipation Properties	Cumulative energy dissipated (k-in.):	480

Mode of failure: Fracture through the column flange and into the panel zone adjacent to the beam bottom flange during the second positive excursion to  $2\delta_y$  cycle.

## DISCUSSION

Specimen UCB-PN2 exhibited significant panel zone yielding during the first excursion to  $2\delta_y$ . There was little visual evidence of yielding in the beam flanges. In addition, slight movement in the shear tab plate due to bolt slip was noted. The specimen failed suddenly during the second positive excursion to  $2\delta_y$ , at 1.57 in. The failure mode involved fracture through the column flange across its entire width at the bottom beam flange. The crack started in the bottom flange weld, extended diagonally through the column flange, and then climbed upwards along the column flange in the panel zone. The length of the crack was approximately 10 in. The maximum plastic rotation of the connection was approximately 0.34% radian. After failure, the test was continued by completing the  $2\delta_y$  cycles. During the negative excursions, the load carrying capacity dropped by only 4% compared with the cycle recorded prior to the failure, indicating that the crack continued to sustain the applied compression forces. In the positive excursions the load resistance was only 30% of the maximum capacity prior to failure. An additional crack, measuring approximately 4 in. long, opened along the bottom continuity plate, and significant yielding of the lower continuity plate was also noted in these cycles. The failure mode of this specimen is very similar to the observed failure mode of specimen UCB-PN1, described in Test Summary No. 10.

## DISCLAIMER

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