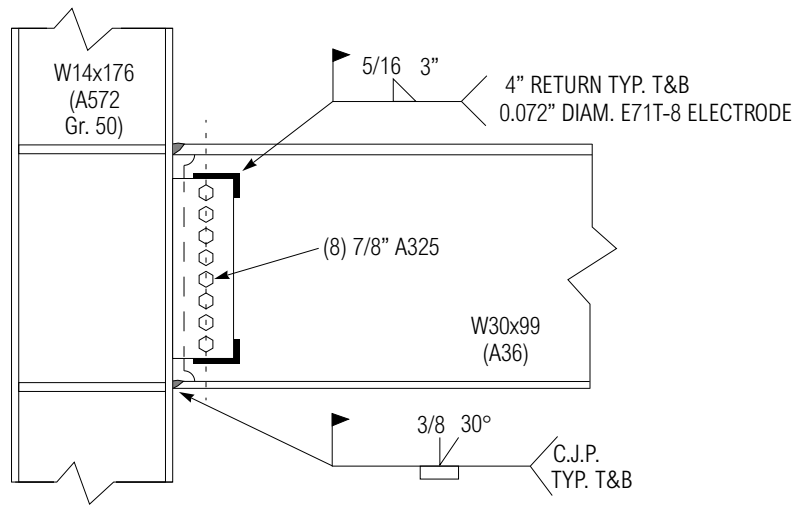


Specimen ID: EERC-PN3  
 Keywords: Pre-Northridge, simulated field welding, panel zone yielding, weld fracture, small rotation capacity  
 Test Location: Earthquake Engineering Research Center, University of California at Berkeley  
 Test Date: March 29-30, 1995  
 Principal Investigator: Vitelmo V. Bertero; with Andrew S. Whittaker and Amir S. Gilani  
 Other Test Summaries: 15  
 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**

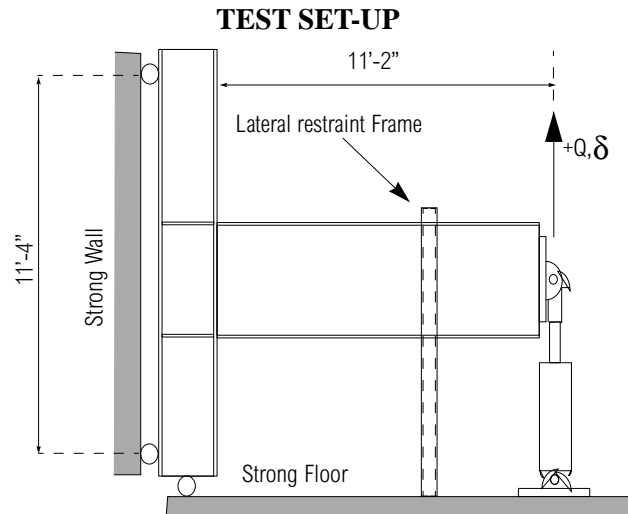
Member	Size	Grade	Yield Stress (ksi)		Ultimate Strength (ksi)	
			mill certs.	coupon tests*	mill certs.	coupon tests*
Beam	W30X99	A36	54.1	47.2 flange 53.4 web	73.4	70.4 flange 72.1 web
Column	W14X176	A572 Gr. 50	56.5	47.1 flange 56.0web	74.5	68.4 flange 72.5web
Welding Procedure Specification	All welds 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	1/2" x 4-1/2" x 23-5/8" plate with eight 7/8" A325 bolts					
Panel zone	No doubler plates					
Continuity plates	3/8" plates with CJP groove weld					
Boundary conditions	Single-sided test, no floor slab, axial load in lower half of column equal to shear in beam, specimen tested in upright position					
Other detailing	Connection between column and beam welded in the upright position					

\*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. 1 and 2. In addition, these were intended to be nearly identical to the specimens described in Test Summaries No. 4, 5, and 6 which were tested at U.C. San Diego. 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 quasi-static testing of the specimen. The yield displacement ( $\delta_y$ ) of the specimen was calculated from nonlinear analysis to be 1.40 in.



## DISPLACEMENT HISTORY AND KEY EXPERIMENTAL OBSERVATIONS

Applied Displacement History	Key Observations of the Test	
	Point	Description
	1	Shear yielding in the panel zone
	2	Local buckling of beam top flange; tensile yielding of beam bottom flange
	3	Local buckling of beam bottom flange
	4	Fracture of welded connection of beam top flange to column flange
5	Fracture of beam bottom flange groove weld	

## DETAILED TEST RESULTS

Quantity (see Introduction for definitions used in EERC tests)		Maxima
Force--Displacement Properties	Peak actuator force (kips):	122
	Beam tip displacement (in.):	2.3
	Experimental yield displacement (in.):	1.1
Rotation Capacity	Maximum plastic rotation (% radian):	2.1
	Cumulative plastic rotation (% radian):	NA
Energy Dissipation Properties	Cumulative energy dissipated (k-in.):	1262

Mode of failure: Fracture of the welded beam top flange to column flange connection during the second negative  $3\delta_y$  cycle.

## DISCUSSION

Specimen EERC-PN3 failed during the second negative displacement excursion to  $3\delta_y$ . The groove welded connection of the beam top flange to the column flange fractured at a beam tip displacement of approximately -3.3 in. during the excursion. After the failure, the test was continued and during the next positive cycle the beam bottom flange connection fractured. Failure of the specimen was preceded by shear yielding in the panel zone, observed starting in the first displacement cycle to  $0.75\delta_y$ . Local buckling of the top flange and tensile yielding of the bottom flange was noted during the third displacement cycle to  $2\delta_y$ . Pronounced buckling of both flanges was observed in the two  $3\delta_y$  cycles prior to the fracture. The maximum plastic rotation of the connection prior to failure was approximately 2.1% radian: 1.1% radian in the panel zone and 1.0% radian in the beam. The panel zone and the beam dissipated similar amounts of energy.

## DISCLAIMER

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