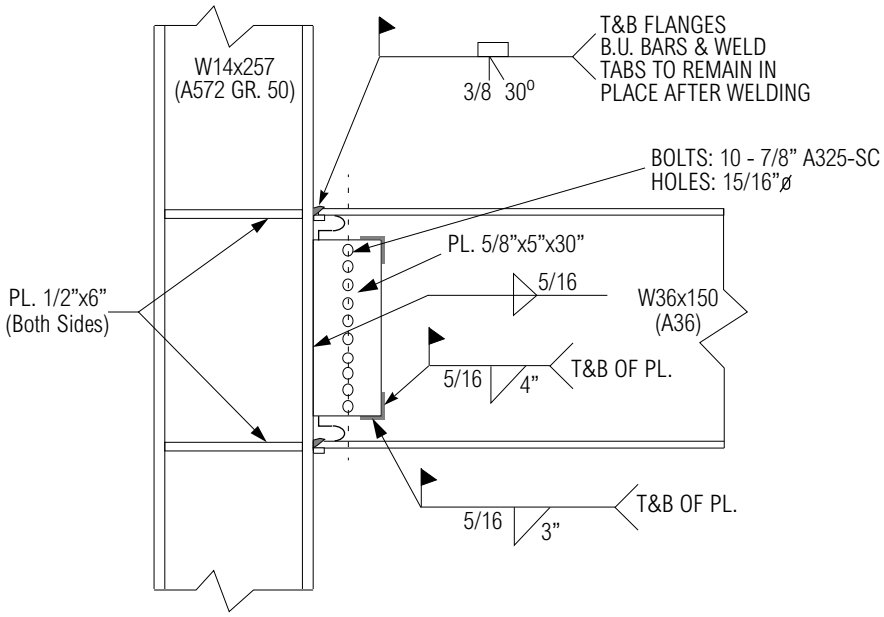
Specimen ID:	UTA-1
Keywords:	Pre-Northridge, simulated field welding, dynamic testing, weld fracture, column flange fracture, shear tab fracture, small rotation capacity
Test Location:	University of Texas, Austin
Test Date:	March 30-31, 1995
Principal Investigator:	Michael D. Englehardt; with Bradley D. Shuey and Thomas A. Sabol
Related Summaries:	20, 21
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	A36	58.5	42.3 flange 47.7 web	67.5	61.1 flange 63.4 web
Column	W14x257	A572 Gr. 50	53.5	48.7 flange	72.5	69.0 flange

Welding Procedure Specification	Fillet Weld: FCAW-SS; 0.072" diameter AWS E71T-8 electrode; conforms with AWS 5.20 specification and Section 4.2 of AWS D1.1-94 CJP groove weld: FCAW-SS; 0.120" diameter AWS E70T-4 electrode; conforms with AWS 5.20 specification and Section 4.2 of AWS D1.1-94
Shear tab	5/8"x30"x5" 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 force in lower half of column equal to beam shear force, specimen tested in upright position
Other detailing	Leave back-up bars and weld tabs in place; root defects determined from UT inspection left in place

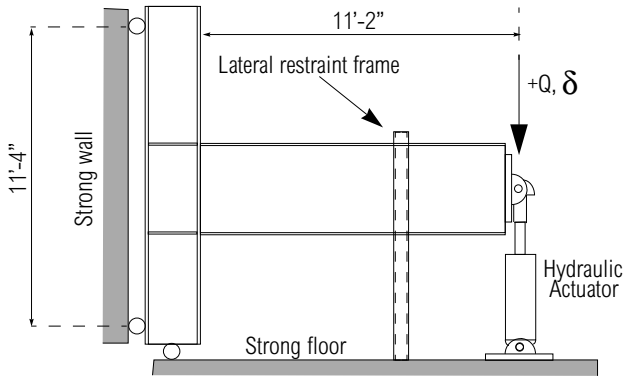
* dynamic stresses; see reference for additional details of coupon tests

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. 8 and 9. In addition, these were intended to be nearly identical to the specimens described in Test Summaries No. 10, 11, and 12 which were tested at U.C. Berkeley. 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.

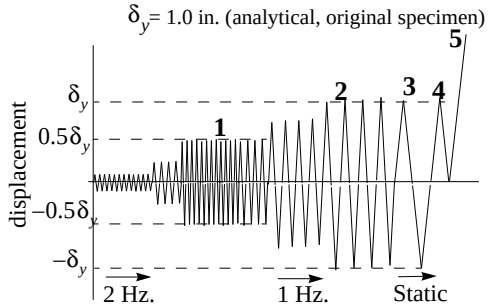
The yield displacement (δ_y) of the specimen was taken to be 1 in. The specimen was subject to dynamically applied cyclic loads, up through the cycles of beam tip displacement of ±1 in. The dynamic loads were applied at frequencies of 1 to 2 Hz, as indicated in the Applied Displacement History shown below. The purpose of the dynamic loading was to subject the specimen to loading rates comparable to a real earthquake, and to provide a comparison with statically loaded companion specimens. Due to limitations in the loading equipment, the dynamic loading was discontinued after four dynamic cycles at ±1 in. Loading was then continued statically for another 1.5 cycles at 1 in. beam tip displacement, at which point specimen failure occurred. Because of difficulties in controlling the dynamic loading, the displacement loading history for this specimen deviated from the standard SAC/ATC-24 loading history.

TEST SET-UP



DISPLACEMENT HISTORY AND KEY EXPERIMENTAL OBSERVATIONS

Applied Displacement History



Key Observations of the Test

Point	Description
1	Clipping of the specified displacement signals
2	Measured displacements deviated from command
3	Slight yielding of beam flanges apparent; some slip between shear tab and beam web
4	Fracture of beam bottom flange across column face and into column flange; fracture of shear tab to the first bolt hole
5	Peak displacement of 2.5 in. Column divot fracture separated from column flange; shear tab fracture propagated; vertical shear tab fillet welds fractured

DETAILED TEST RESULTS

Quantity (see Introduction for definitions used in UTA tests)		Maxima
Force/Displacement Properties	Peak actuator force (kips):	~130
	Beam tip displacement (in.):	1.0
	Experimental yield displacement (in.)	NA
Rotation Capacity	Maximum plastic rotation (% radian):	~0
	Cumulative plastic rotation (% radian):	~0
Energy Dissipation Properties	Cumulative energy dissipated (k-in.):	~0

Mode of failure: Fracture of the beam bottom flange weld and divot fracture into the column flange during the second static displacement cycle to $1\delta_y$ cycle.

DISCUSSION

Specimen UTA-1 failed suddenly in the first half of the second loading cycle to a displacement of $1\delta_y$ (+1.0 in.) when a fracture developed in the weld between the beam bottom flange and the column flange. On one side of the beam web the fracture ran along the weld/column interface line, while on the opposite side of the web it extended from the weld root into the face of the column flange, carving out a crescent-shaped divot from the flange. A small crack also developed in the lower portion of the shear tab that extended up to the first bolt hole.

After this initial failure occurred, the specimen was brought back to its initial position and then displaced to +2.5 in. This half-cycle of loading caused the divot to pull away from the column face, revealing the depth of the fracture to be approximately 1 in. The vertical portions of the supplemental fillet welds between the shear tab and the beam web also fractured during this half-cycle.

The specimen did not experience any significant plastic deformations or rotations during this test, and the beam experienced only minor yielding.