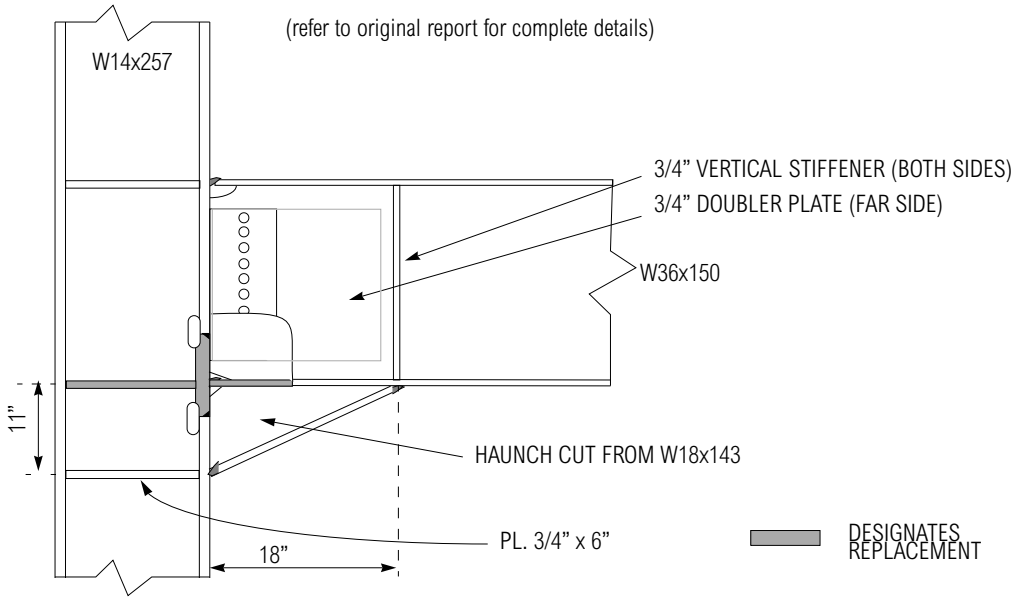
Specimen ID:	UTA-1R
Keywords:	Repair, bottom haunch, beam and column splice plates, web doubler plate, flange and web yielding, top weld fracture, medium rotation capacity
Test Location:	University of Texas, Austin
Test Date:	October 20, 1995
Principal Investigator:	Michael D. Englehardt; with Bradley D. Shuey and Thomas A. Sabol
Related Summaries:	7, 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

(refer to original report for complete details)



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
Haunch	W18x143	A572 Gr. 50	N.A.	46.2 flange	N.A.	70.7 flange
Web doubler plate	3/4" plate	A572 Gr. 50	N.A.	N.A.	N.A.	N.A.
Column flange splice	2" plate	A572 Gr. 50	N.A.	N.A.	N.A.	N.A.
Beam flange splice	1" plate	A572 Gr. 50	N.A.	N.A.	N.A.	N.A.
Vertical stiffeners	3/4" plates	A572 Gr. 50	N.A.	N.A.	N.A.	N.A.

Welding Procedure Specification	Original: see Test Summary No. 7 Modifications: All welds FCAW-SS using 0.072" diameter AWS E71T-8 electrode. (Repair to top flange uses AWS E70T-8.)
Shear tab	5/8"x30"x5" plate, added 3/4" beam web doubler plate welded to beam web and column flange
Panel zone	No doubler plates
Continuity plates	1/2" plates with c.p. weld, replace bottom plate, add 3/4" plate at bottom of haunch 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	Backup bars removed at top flange, weld root back-gouged and replaced

N.A. = not available

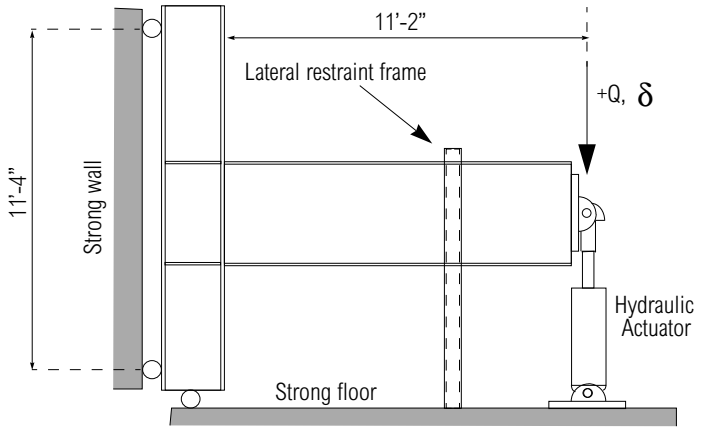
* dynamic stresses; see reference for additional details of coupon tests

BACKGROUND

This was a test of repairs to specimen UTA-1 (Test Summary No. 7), which was originally tested on March 30-31, 1995. The original specimen failed in the first half of the second displacement cycle to $1\delta_y$ without undergoing any significant plastic deformation. When a fracture developed at the beam bottom flange connection. The right half of the bottom flange connection fractured at the weld column interface; the left half fractured into the column flange face in a crescent/divot shape. The fracture extended from the weld root and terminated at a point inside the column flange. The shear tab fractured from the bottom edge into the first bolt hole.

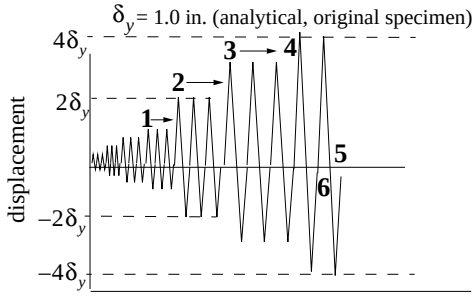
The repair procedure included, cutting an access hole in the beam bottom flange, removing the bottom continuity plate, cutting column web access holes, removing the damaged portion of the column flange and replacing it with a new plate, installing new continuity plates, installing new material at the beam bottom flange, removing the shear tab bolts, installing a web doubler plate on the beam side opposite the shear tab, installing a bottom haunch, installing vertical beam stiffeners at the end of the haunch, and repairing the root of the top weld. The displacement loading history followed the standard SAC/ATC-24 protocol. A yield displacement (δ_y) of 1.0 in. was assumed for the repaired specimen to be consistent with that used in the test of the original specimen.

TEST SET-UP



DISPLACEMENT HISTORY AND KEY EXPERIMENTAL OBSERVATIONS

Applied Displacement History



Key Observations of the Test

Point	Description
1	Yielding of beam flanges outside the haunch
2	Increased beam flange yielding, panel zone yielding, beam web yielding
3	Column rear flange yielding, slight buckling in beam top flange and beam web
4	Substantial top flange buckling, slight bottom flange buckling
5	Failure of original top shear tab supplemental weld
6	Fracture through weld at beam top flange to column connection

DETAILED TEST RESULTS

Quantity (see Introduction for definitions used in UTA tests)		Maxima
Force/Displacement Properties	Peak actuator force (kips):	~280
	Beam tip displacement (in.):	4.0
	Experimental yield displacement (in.)	NA
Rotation Capacity	Maximum plastic rotation (% radian) face of column/face of haunch:	1.9/2.2
	Cumulative plastic rotation (% radian):	NA
Energy Dissipation Properties	Cumulative energy dissipated (k-in.):	NA

Mode of failure: Fracture through weld at the beam top flange to column connection during the $4\delta_y$ displacement cycle.

DISCUSSION

Specimen UTA-1R failed in the second half of the second displacement cycle to $4\delta_y$ at a tip displacement of -0.21 in. Failure occurred when a sudden fracture developed at the beam top flange to column weld. Initial yielding occurred during the $0.75\delta_y$ cycles in the beam flanges outside the haunch region. The yielding pattern continued during the $1\delta_y$ and $2\delta_y$ cycles. At the bottom flange, yielding developed only outside the haunch face. At the top flange, it progressed into the haunch region. During the $2\delta_y$ cycles, panel zone yielding and beam web yielding outside the haunch-stiffener region was noted. The onset of beam flange local buckling, yielding of the rear column flange, and visible column joint rotation was observed during the $3\delta_y$ cycles. The buckling in the beam occurred outside of the haunch/stiffener region and became more severe in both the web and flanges during the $4\delta_y$ cycles. During the second $4\delta_y$ cycle, sudden fracture of the original top shear tab supplemental weld preceeded the fracture across the beam top flange weld. The maximum plastic rotation of the connection was approximately 2.2% radian.