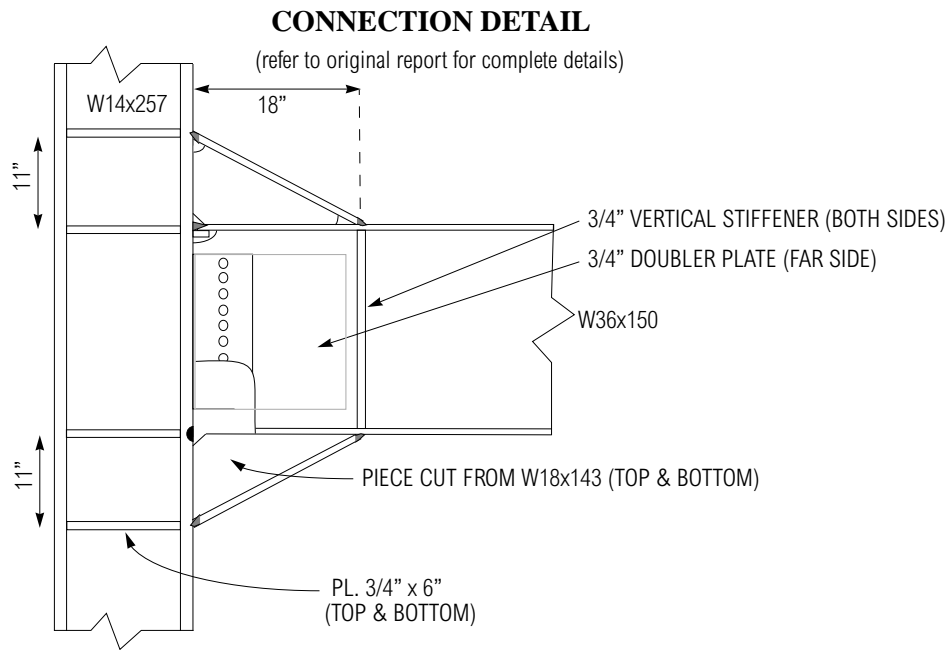


Specimen ID: UTA-3R  
 Keywords: Repaired, top and bottom haunch, web doubler plate, flange and web buckling, specimen twisting, medium rotation capacity  
 Test Location: University of Texas, Austin  
 Test Date: November 8, 1995  
 Principal Investigator: Michael D. Englehardt; with Bradley D. Shuey and Timothy Portyaj  
 Related Summaries: 9  
 Reference: "Experimental Investigations of Beam-Column Subassemblages", *Report No. SAC 96-01*, March 1996.  
 Funding Source: FEMA / SAC Joint Venture, Phase I



**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.
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.					
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	Beam bottom flange not rewelded to the column flange, no repairs to top flange					

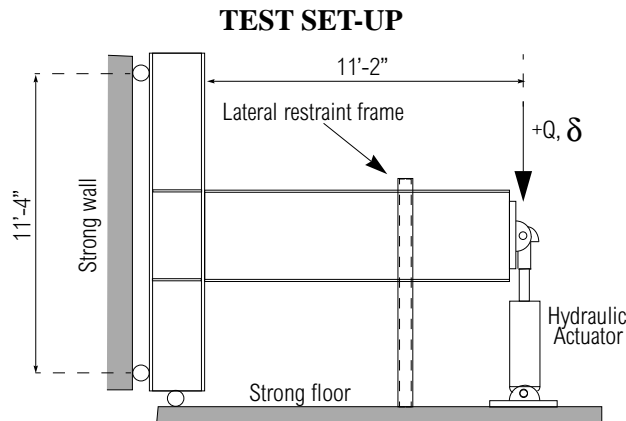
N.A. = not available

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

## BACKGROUND

This was a test of repairs to specimen UTA-3 (Test Summary No. 9) which was originally tested on March 30-31, 1995. The original specimen failed in the first cycle of displacement to  $2\delta_y$  when the bottom beam flange-to-column flange weld fractured suddenly. On the left side of the beam web, the fracture propagated along the weld-column interface; on the right half of the beam web the fracture propagated into the column flange face in a crescent/divot shape. The shear tab also fractured from its bottom edge to the first bolt hole.

The repair schedule consisted of removing the beam material adjacent to the bottom weld access hole, repairing the large divot in the column flange by buttering it with weld material, removing the shear tab bolts, installing continuity plates for the top and bottom haunches, installing a beam web doubler plate on the side opposite to the existing shear tab and welding this to the column flange and beam web, groove welding the haunch flanges to the column flange and beam flanges, fillet welding the haunch webs to the beam flanges, and installing web vertical stiffeners at the end of the haunched region. The displacement loading history followed the standard SAC/ATC-24 protocol. The reference displacement ( $\delta_y$ ) we assumed to be 1.00 in. to provide consistency with the original test of this specimen.



## DISPLACEMENT HISTORY AND KEY EXPERIMENTAL OBSERVATIONS

Applied Displacement History	Key Observations of the Test	
<p style="text-align: center;"><math>\delta_y = 1.0</math> in. (analytical, original specimen)</p>	Point	Description
	1	Yielding of beam top and bottom flanges outside the haunch
	2	Slight beam web yielding outside the haunch and some vertical stiffener yielding
	3	Buckling of beam flanges and web outside the haunch, slow reduction in load carrying capacity
	4	Severe beam flange and web buckling outside of haunch
	5	Test termination due to severe twisting of the specimen

## 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:	2.3/2.6
	Cumulative plastic rotation (% radian):	NA
Energy Dissipation Properties	Cumulative energy dissipated (k-in.):	NA

Mode of failure: No material fracture or substantial degradation in strength observed; tests stopped after displacement cycles to  $4\delta_y$  due to severe twisting in the specimen.

## DISCUSSION

Specimen UTA-3R exhibited yielding in the top and bottom flanges of the beam outside of the haunch region during the displacement cycles to  $0.75\delta_y$ . This yielding continued to spread during the displacement cycles to  $2\delta_y$  and  $3\delta_y$ . Slight yielding in the beam web outside of the haunch zone and in the web vertical stiffeners was also observed, and during the displacement cycles to  $3\delta_y$ , both the beam flanges and web started to buckle. The severity of buckling increased with each cycle, and the load maxima slowly reduced. At the completion of the  $3\delta_y$  cycles, the specimen was twisted substantially. During the first displacement cycle to  $4\delta_y$ , the beam experienced severe flange and web buckling, and the specimen was twisting severely at the face of the haunch. The test was stopped at this point to avoid damaging the loading apparatus. There was no sign of material fracture anywhere within the specimen. The maximum plastic rotation of the connection was approximately 2.3% radian (measured to the face of the column). Almost all of this rotation was associated with the beam.

## DISCLAIMER

This summary has been prepared from the cited reference. The SAC Joint Venture has not verified any of the results presented herein, and no warranty is offered with regard to the results, findings, and recommendations presented, either by the Federal Emergency Management Agency, the SAC Joint Venture, the individual joint venture partners, their directors, members, or employees. These organizations and individuals do not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any of the information, products, or processes included in this publication. The reader is cautioned to carefully review the material presented herein. More detailed information is available in the cited reference.