Seismic Behavior of Special Concentric Braced Frames under Short- and Long-Duration Ground Motions

APPENDICES

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Appendix A Specimen Shop Drawings

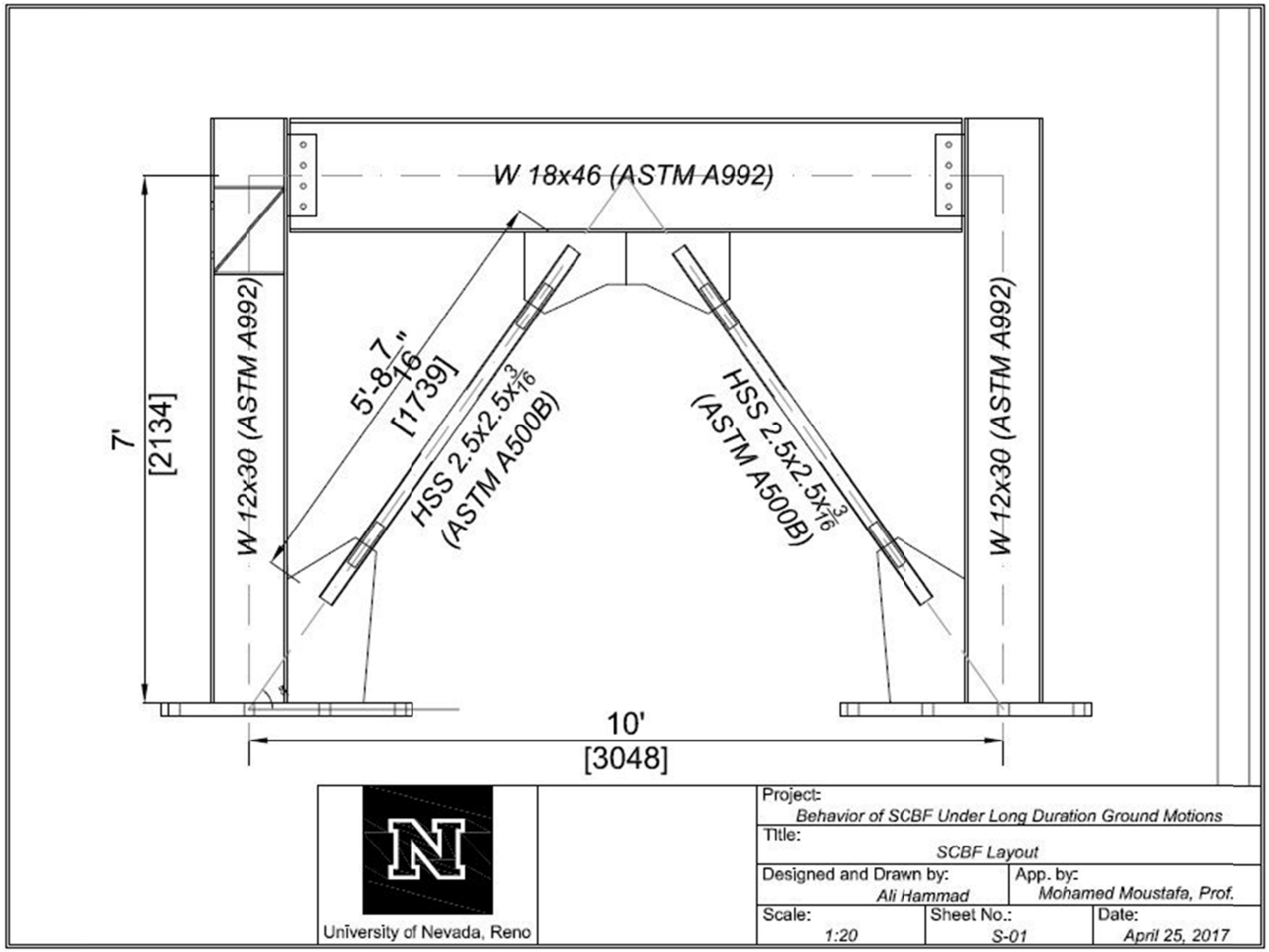


Figure A.1 Frame layout.

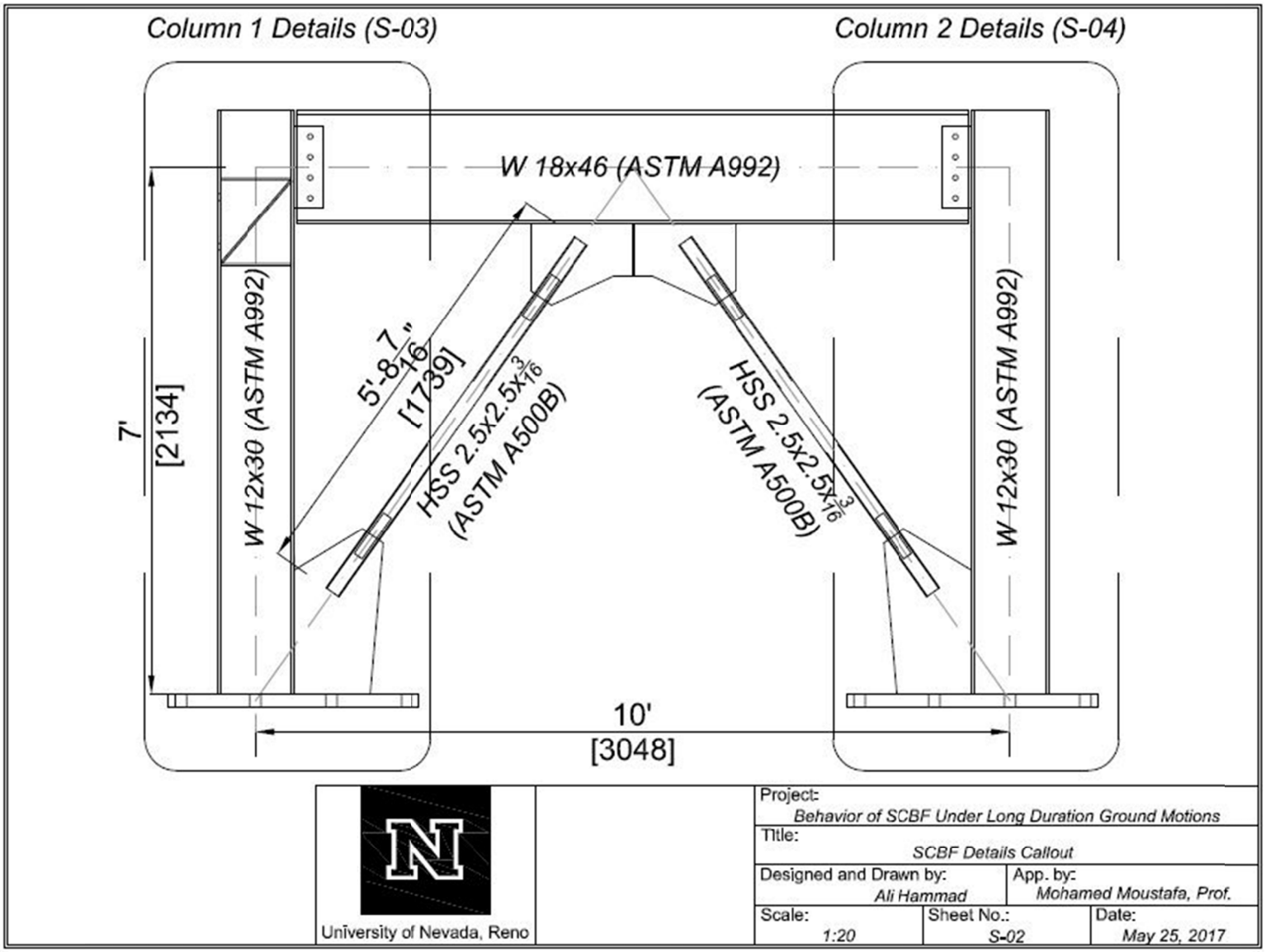


Figure A.2 Frame details callout.

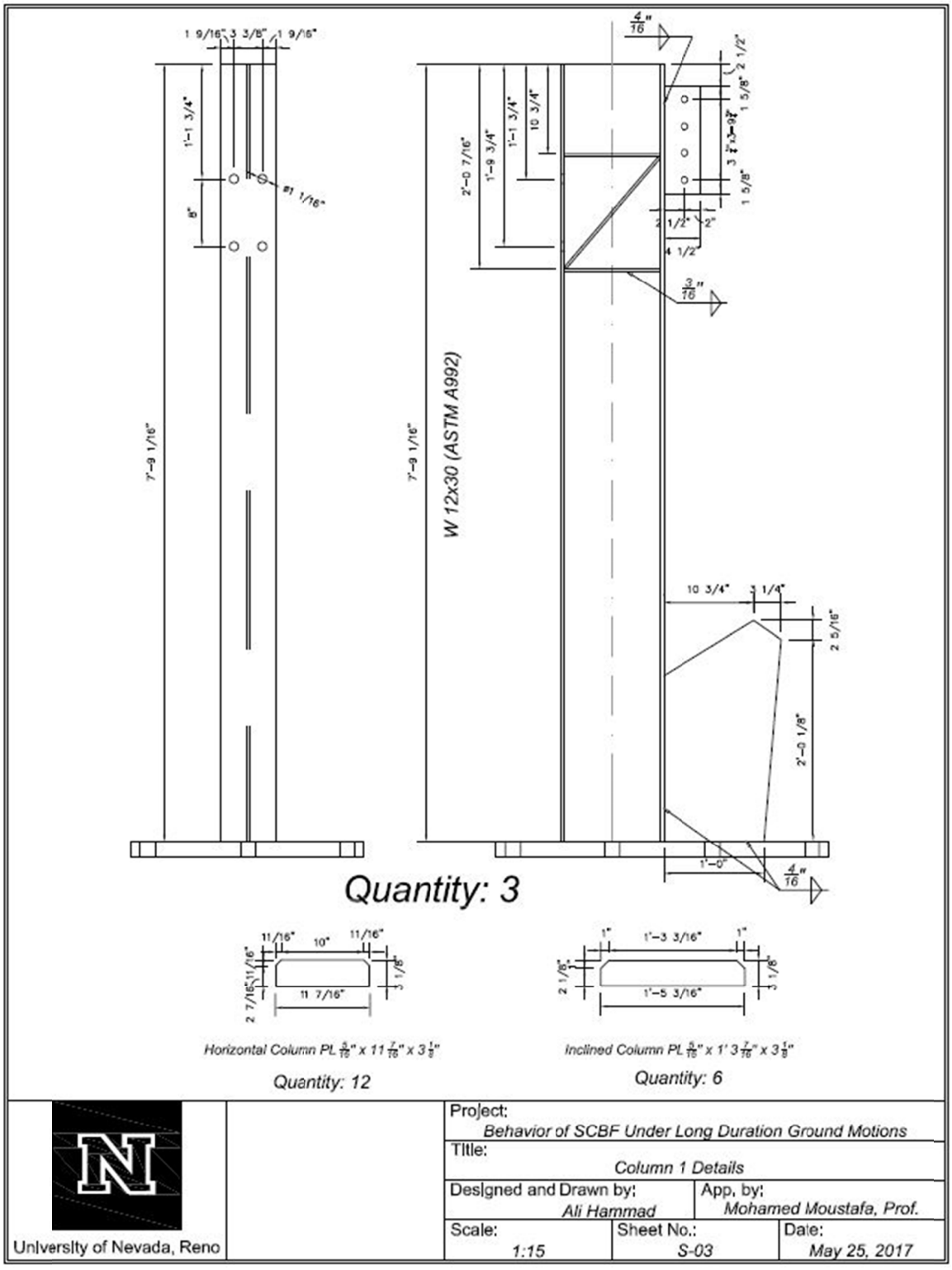


Figure A.3 South column details.

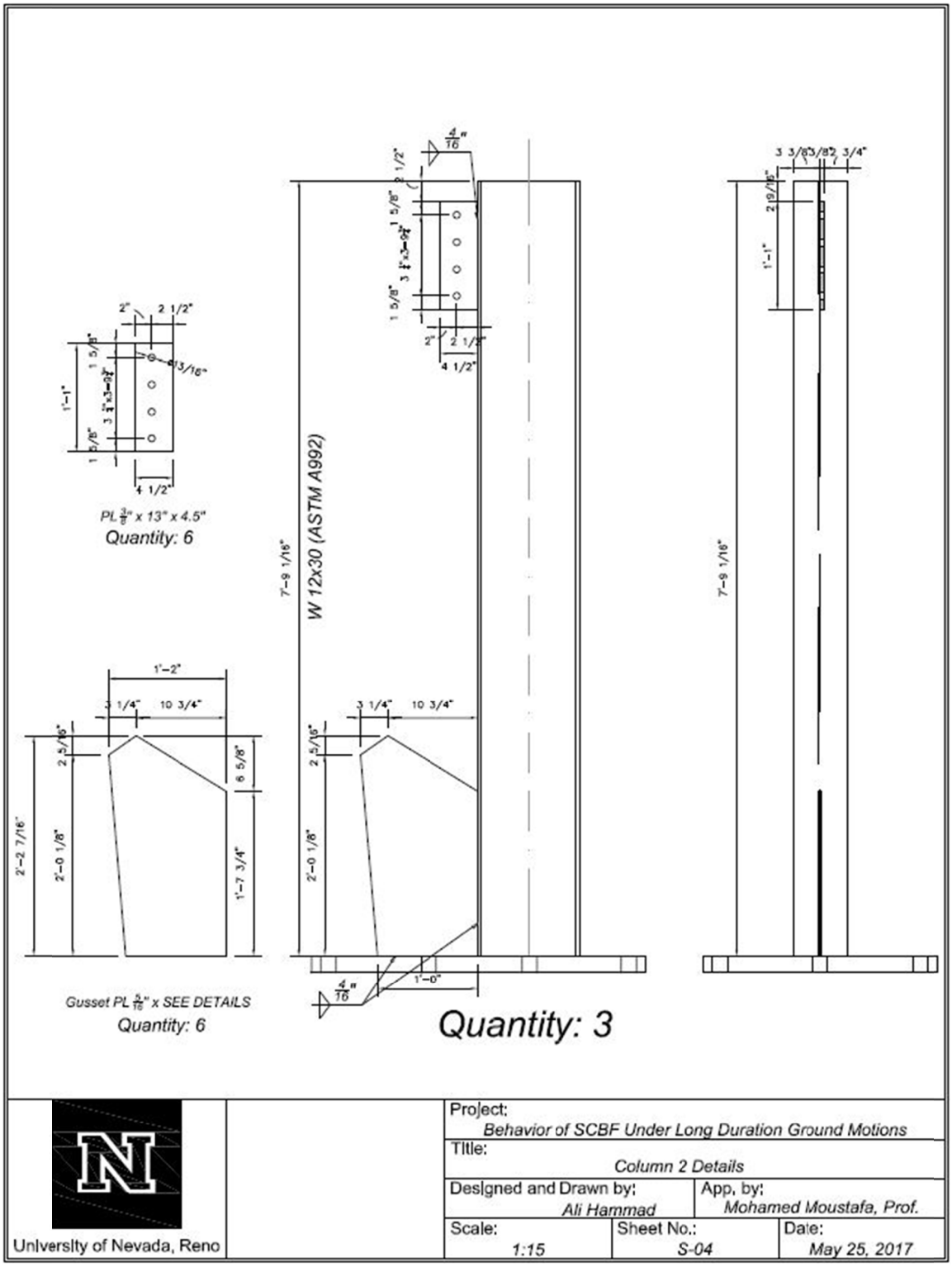
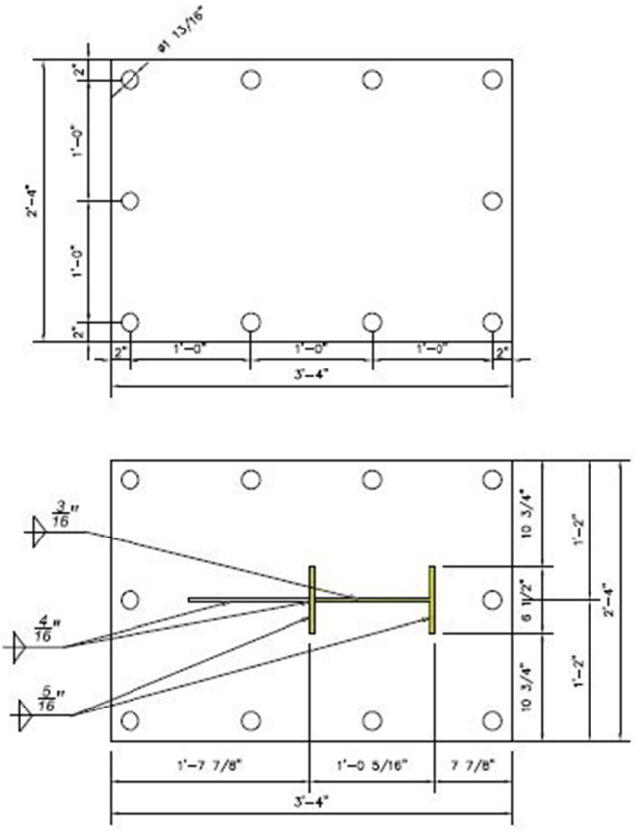


Figure A.4 North column details.



Base Plate 2" x 3' 4" x 2' 4"
(ASTM A572 GR.50)
Quantity: 6

University of Nevada, Reno	Project: *Behavior of SCBF Under Long Duration Ground Motions*	
	Title: *Base Plate Details*	
	Designed and Drawn by: *Ali Hammad*	App. by: *Mohamed Moustafa, Prof.*
	Scale: *1:15*	Sheet No.: *S-05* / Date: *May 25, 2017*

Figure A.5 Base plate details.

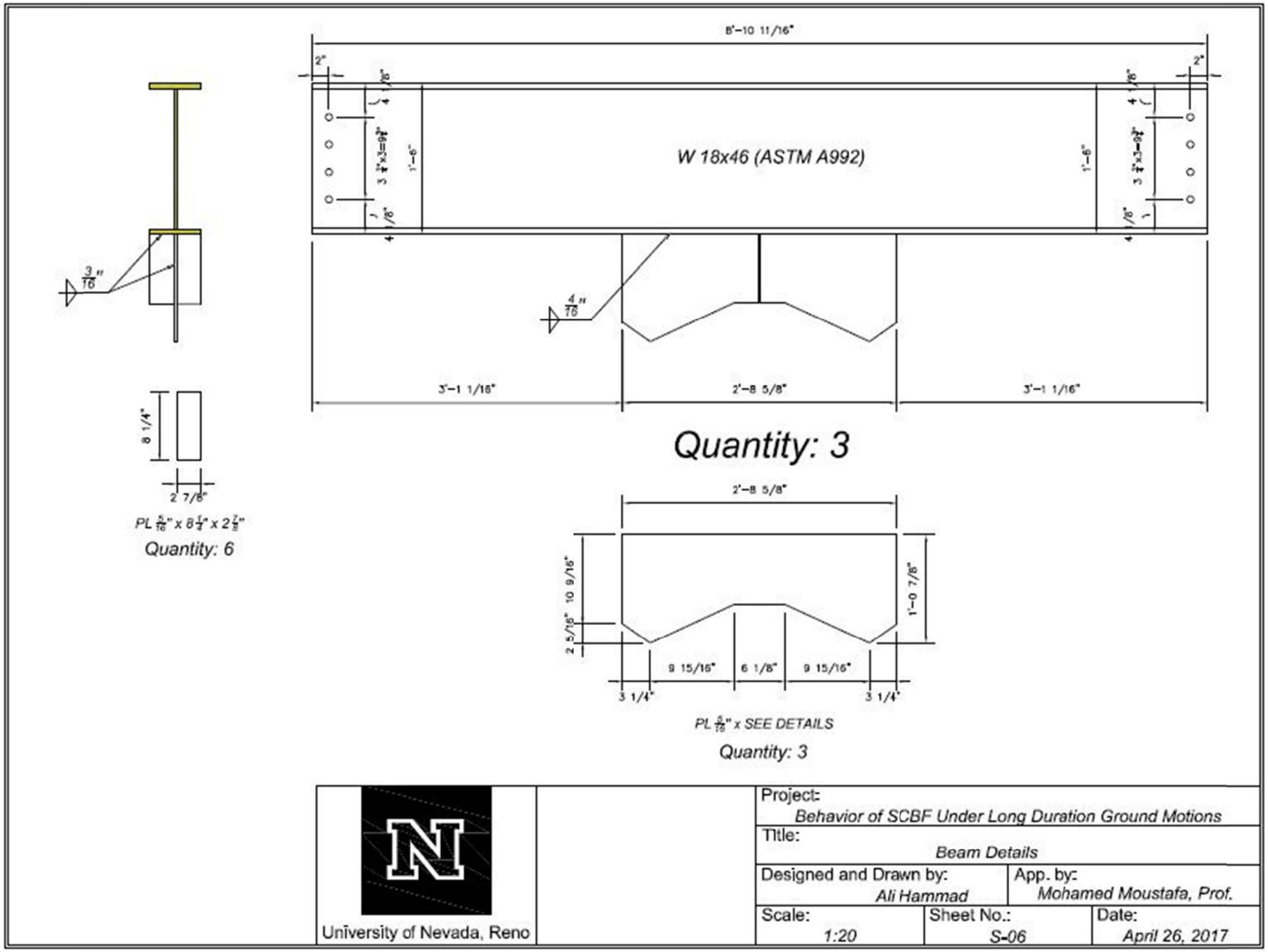


Figure A.6 Beam details.

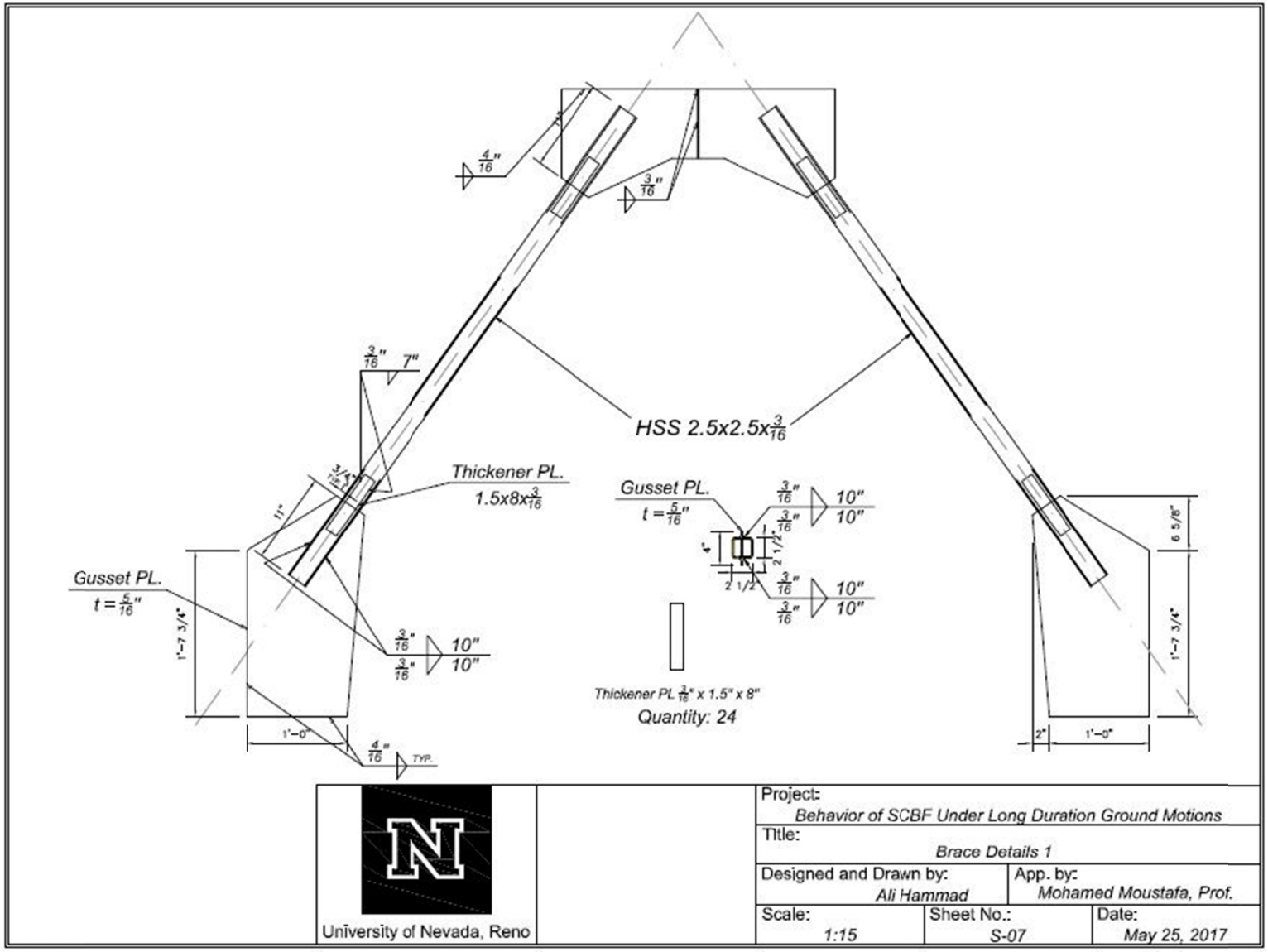


Figure A.7 Braces details 1.

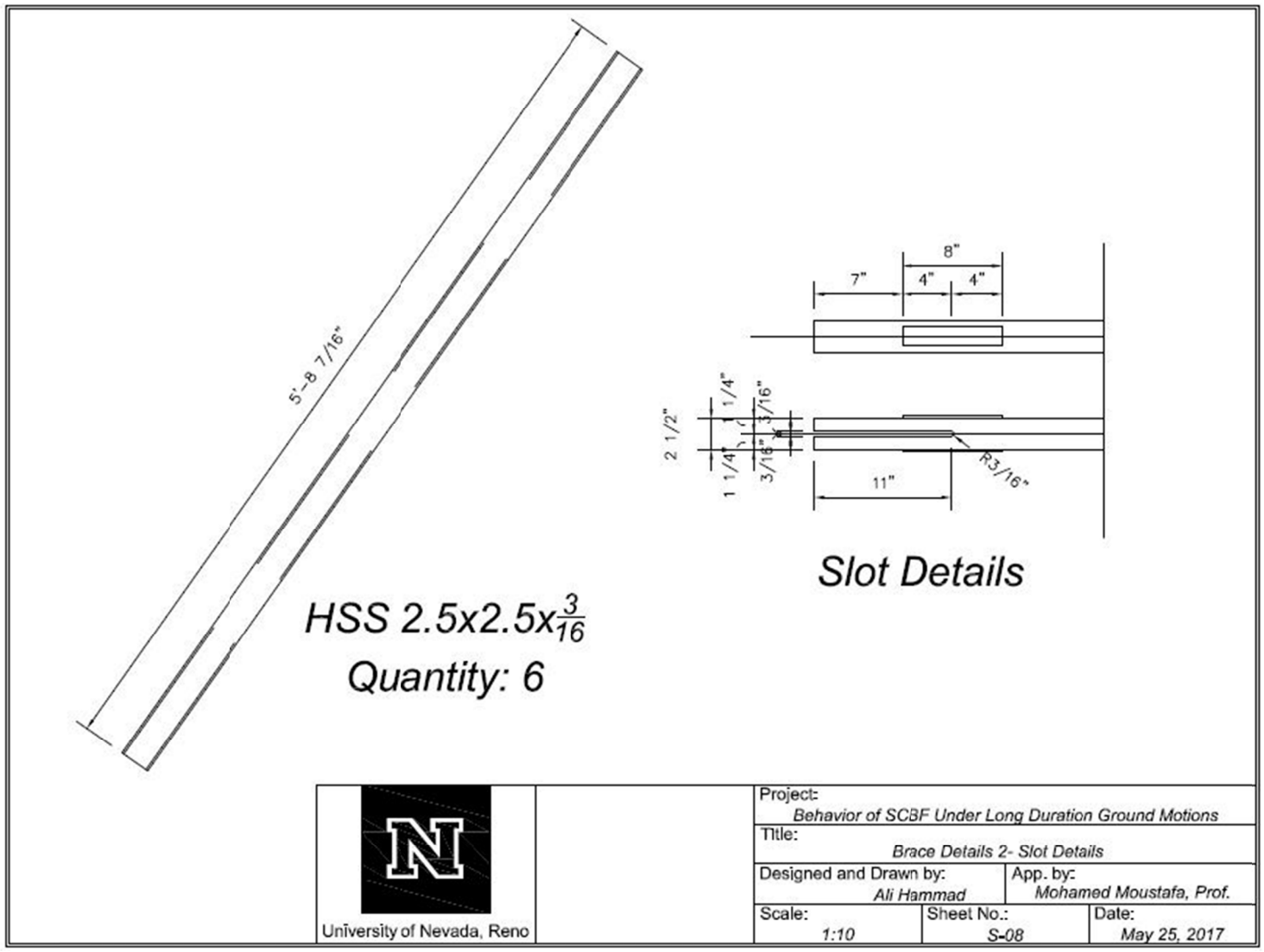


Figure A.8 Braces details 2.

Appendix B Specimens Fabrication

Figure B.1 Braces with slots.

Figure B.2 Shear tab plate and column stiffeners

Figure B.3 Bottom gusset plate welded to the base plate and the column flange.

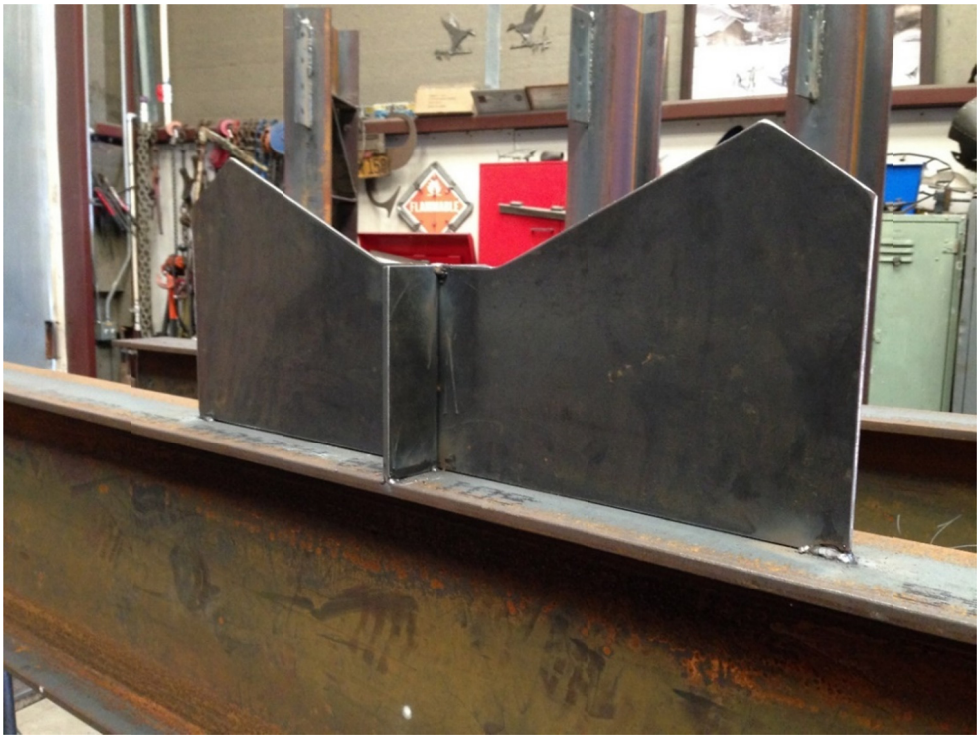


Figure B.4 Upper gusset plate welded to the beam flange (upside down).

Figure B.5 Plate after all the connecting plates where cut.

Figure B.6 Three fully fabricated specimens.

Figure B.7 Specimen lifted for placing at the testing site.

Appendix C Test Setup and Instrumentation

Figure C.1 Specimen lifted for placing in the laboratory.

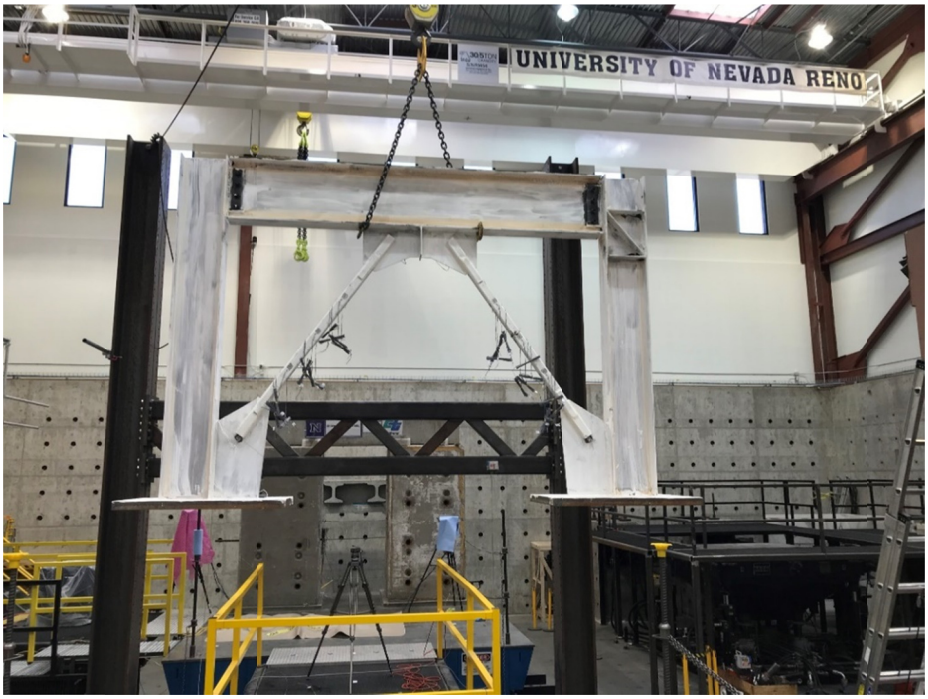


Figure C.2 Specimen lifted for placing on the shake table.

Figure C.3 Alignment anchors on the shake table.

Figure C.4 Placing specimen on the shake table.

Figure C.5 Uncentered anchor with base plate hole.

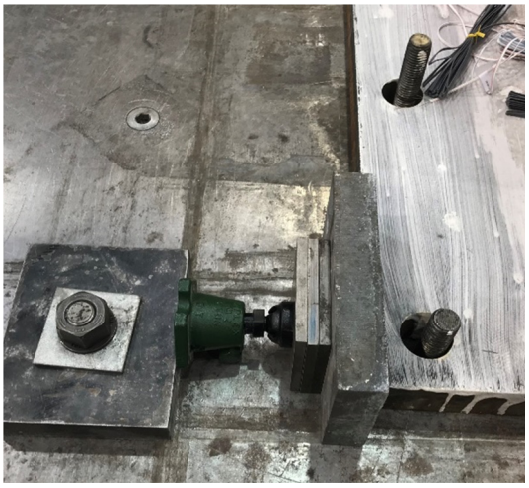


Figure C.6 Centering table anchors with base plate holes.

Figure C.7 Anchors centered with base plate holes.

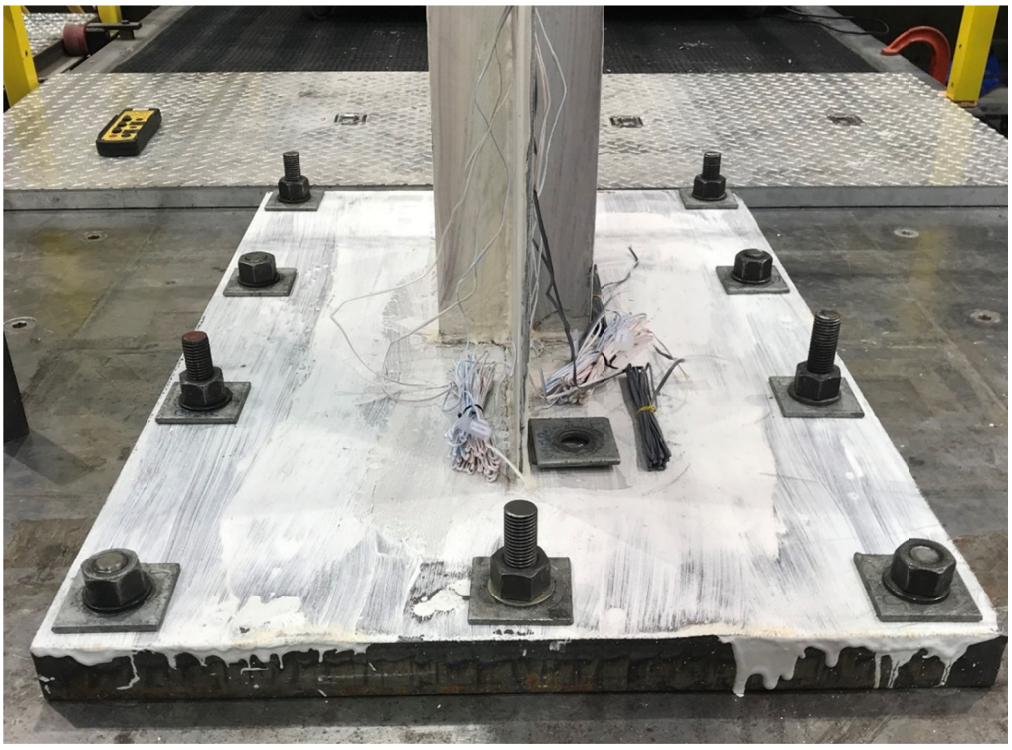


Figure C.8 Anchors tied down after centering with base plate holes.

Figure C.9 Holding link attached to mass rig.

Figure C.10 Raising link attached to mass rig.

Figure C.11 Connecting link to specimen column flange.

Figure C.12 Final link attached to mass rig and specimen.

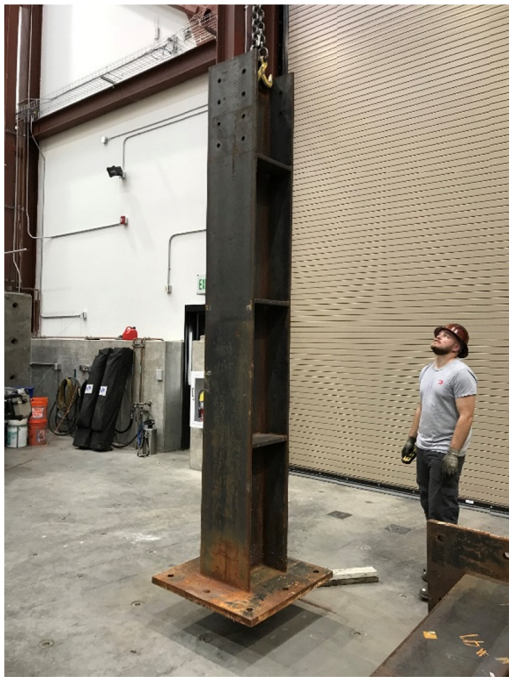


Figure C.13 Out-of-plane restraining column.

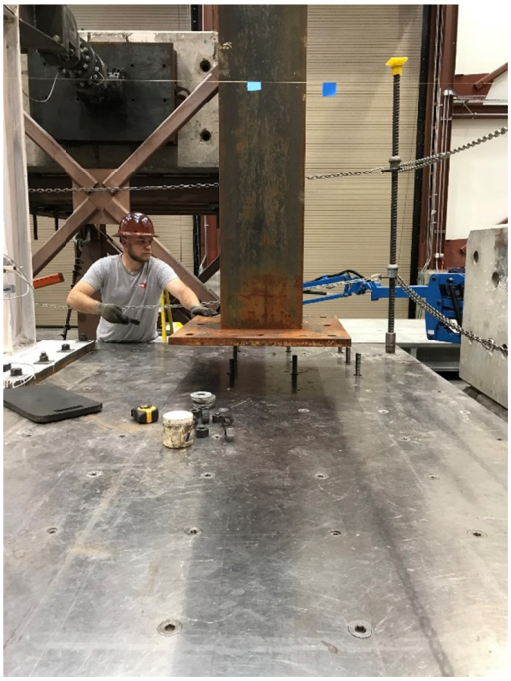


Figure C.14 Out-of-plane restraining column positioning on the shake table.

Figure C.15 Out-of-plane restraining link attached to restraining column.

Figure C.16 Out-of-plane restraining link attached to specimen column flange.

Figure C.17 Hose clamps around braces for out-of-plane strain pots.

Figure C.18 L-bracket attached to braces hose clamps with wire pot attached.

Figure C.19 LVDT's attached to middle gusset plate.

Figure C.20 LVDT's Attached to south gusset plate.

Figure C.21 LVDT's attached to north gusset plate.

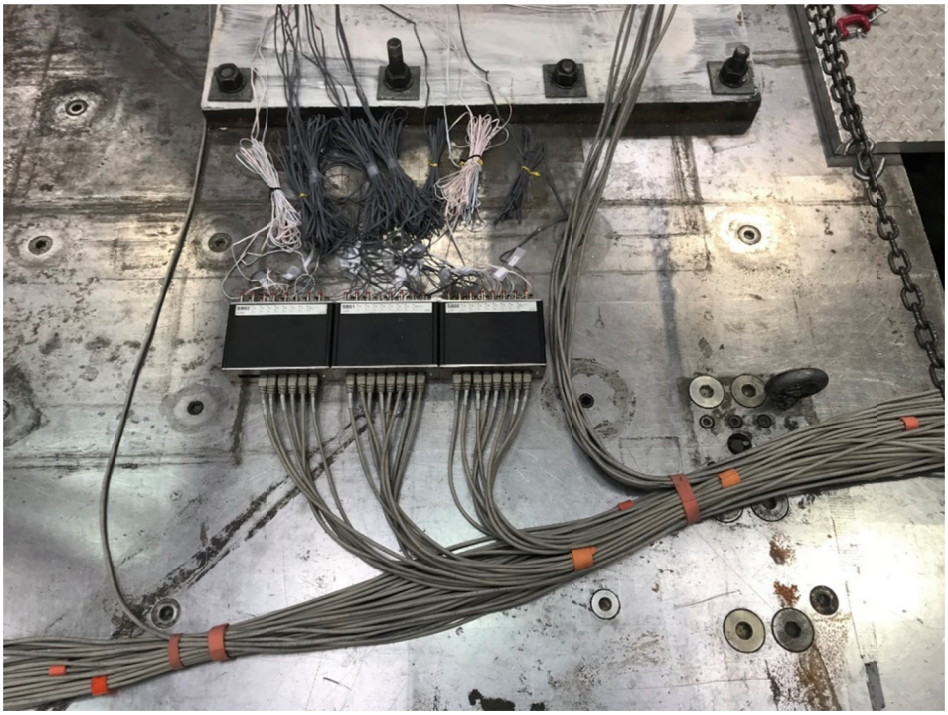


Figure C.22 All wires connected to connection boxes.

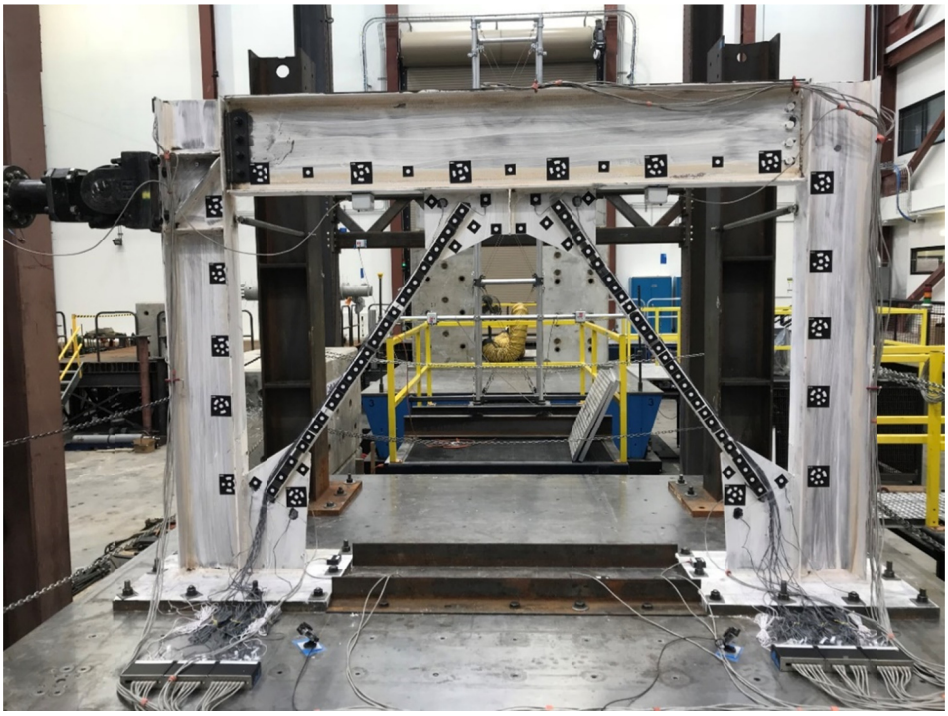


Figure C.23 Specimen ready for testing.

Appendix D Ground Motions for Analysis

The list of 44 spectrally-matched pairs of short and long-duration ground motions adopted after Chandramohan (2016a, b) is shown in Table D.1.

Table D.1 Short- and long-duration ground-motion pairs.

Pair no.	Earthquake	Station name	Scale factor	Ds 5-75 (sec)
1	1990 Manjil, Iran	Abbar	---	7.4
	2011 Tohoku, Japan	Ogano	5.00	37.6
2	1990 Manjil, Iran	Abbar	---	11.5
	2011 Tohoku, Japan	Yamagata	5.00	70.2
3	1999 Kocaeli, Turkey	Arcelik	---	7.6
	2011 Tohoku, Japan	Edosaki	0.41	27.8
4	1999 Kocaeli, Turkey	Arcelik	---	5.1
	1999 Chi-Chi, Taiwan - 4	CHY116	4.43	35.5
5	1999 Duzee, Turkey	Bolu	---	2.6
	2011 Tohoku, Japan	Takahagi	1.30	38.9
6	1999 Duzee, Turkey	Bolu	---	1.5
	1985 Michoacan, Mexico	Villita Corona Centro	1.16	33.6
7	1989 Loma Prieta, USA	Capitola Fire station	---	5.7
	2011 Tohoku, Japan	Hachiohji	3.84	46.0
8	1989 Loma Prieta, USA	Capitola Fire station	---	5.6
	2011 Tohoku, Japan	Sendai	0.58	55.5
9	1999 Chi-Chi, Taiwan	CHY101	---	13.5
	2010 El Mayor-Cucapah, USA	Ejido Saltillo	1.85	33.3
10	1999 Chi-Chi, Taiwan	CHY101	---	10.3
	1999 Chi-Chi, Taiwan - 4	CHY058	5.00	30.8
11	1992 Landers, USA	Coolwater	---	5.9
	2011 Tohoku, Japan	Aizutakada	1.53	66.6
12	1992 Landers, USA	Coolwater	---	3.8
	2008 Wenchuan, China	Hanyuanjiuxiang	4.37	38.2
13	1979 Imperial Valley, USA	Delta	---	24.2
	2011 Tohoku, Japan	Takasato	1.78	66.5

Pair no.	Earthquake	Station name	Scale factor	Ds 5-75 (sec)
14	1979 Imperial Valley, USA	Delta	---	22.4
	2011 Tohoku, Japan	Tomioka	4.16	44.6
15	1999 Kocaeli, Turkey	Duzee	---	6.1
	2011 Tohoku, Japan	Yamagata	1.79	78.8
16	1999 Kocaeli, Turkey	Duzee	---	2.1
	2011 Tohoku, Japan	Namie	0.97	63.6
17	1979 Imperial Valley, USA	El Centro Array #11	---	4.5
	2011 Tohoku, Japan	Kakunodate	5.00	53.8
18	1979 Imperial Valley, USA	El Centro Array #11	---	4.6
	2011 Tohoku, Japan	Nagawa	2.76	53.2
19	1989 Loma Prieta, USA	Giroy Array #3	---	1.7
	2011 Tohoku, Japan	Angol	0.77	30.2
20	1989 Loma Prieta, USA	Giroy Array #3	---	3.1
	2011 Tohoku, Japan	Tendou	2.07	71.2
21	1999 Hector Mine, USA	Hector	---	6.4
	2011 Tohoku, Japan	Kawaguchi	1.08	45.7
22	1999 Hector Mine, USA	Hector	---	7.6
	2011 Tohoku, Japan	Hachieda	1.14	40.5
23	1971 San Fernando, USA	Los Angeles - Hollwood Storage Grounds	---	5.1
	2007 Chuetsu-oki, Japan	NIG011	4.04	25.7
24	1971 San Fernando, USA	Los Angeles - Hollwood Storage Grounds	---	4.8
	2011 Tohoku, Japan	Hannoh	3.53	45.9
25	1987 Superstition Hills, USA	El Centro Imperial County Center Grounds	---	7.0
	2011 Tohoku, Japan	Kumagaya	2.23	43.7
26	1987 Superstition Hills, USA	El Centro Imperial County Center Grounds	---	7.6
	2003, Hokkaido, Japan	Date	4.14	28.4
27	1994 Northridge, USA	Canyob Country - 16628 W. Lost Canyon Road	---	3.1
	2011 Tohoku, Japan	Shuzenji	5.00	57.0
28	1994 Northridge, USA	Canyob Country - 16628 W. Lost Canyon Road	---	2.9
	2011 Tohoku, Japan	Hijiori	4.73	68.8
29	1994 Northridge, USA	Beverly Hills - 14145 Mulholland Drive	---	6.1
	2011 Tohoku, Japan	Yokoami	1.88	42.0
30	1994 Northridge, USA	Beverly Hills - 14145 Mulholland Drive	---	5.0
	2011 Tohoku, Japan	Shiroishi	1.60	70.4
31	1995 Kobe, Japan	Nishi-Akashi	---	4.0
	2011 Tohoku, Japan	Atsugi	3.02	48.1
32	1995 Kobe, Japan	Nishi-Akashi	---	4.5
	2002 Denali, USA	Faibanks - Geophysical Observatory, CIGO	5.00	27.7

Pair no.	Earthquake	Station name	Scale factor	Ds 5-75 (sec)
33	1987 Superstition Hills, USA	Poe Road (temp)	---	9.8
	2011 Tohoku, Japan	Kuji	2.25	53.1
34	1987 Superstition Hills, USA	Poe Road (temp)	---	11.2
	2011 Tohoku, Japan	Ashiro	2.29	54.4
35	1992 Cape Mendocino, USA	Rio Dell Overpass	---	4.3
	1985 Valparaiso, Chile	Valparaiso El Almendral	1.11	31.1
36	1992 Cape Mendocino, USA	Rio Dell Overpass	---	1.9
	1985 Valparaiso, Chile	Caquenes	5.00	25.2
37	1995 Kobe, Japan	Shin-Osaka	---	3.6
	2011 Tohoku, Japan	Nishikawa-E	2.43	71.7
38	1995 Kobe, Japan	Shin-Osaka	---	4.5
	2011 Tohoku, Japan	Hasaki2	1.13	28.7
39	1999 Chi-Chi, Taiwan	TCU045	---	7.4
	2008 Wenchuan, China	Hongyatai	2.95	38.8
40	1999 Chi-Chi, Taiwan	TCU045	---	8.7
	1985 Valparaiso, Chile	Llolloe	0.61	27.5
41	1976 Friuli, Italy	Tolmezzo	---	2.5
	2011 Tohoku, Japan	Kohriyama	0.48	67.5
42	1976 Friuli, Italy	Tolmezzo	---	2.5
	2011 Tohoku, Japan	Nakaminto	0.59	34.4
43	1922 Landers, USA	Yermo Fire Station	---	7.1
	2011 Tohoku, Japan	Hachinohe	1.51	62.7
44	1922 Landers, USA	Yermo Fire Station	---	10.9
	2011 Tohoku, Japan	Ukita	0.94	44.8