

Appendix A Monotonic Connection Test Data

A.1 – Monotonic Connection Test Data

The following data corresponds to all monotonic connection tests performed during this study. Each test was analyzed for strength and stiffness properties per Chapter 3, Section 3.5.7. See Figure A.1. Test identification can be cross-referenced to Table 3.1 based on Figure A.1.

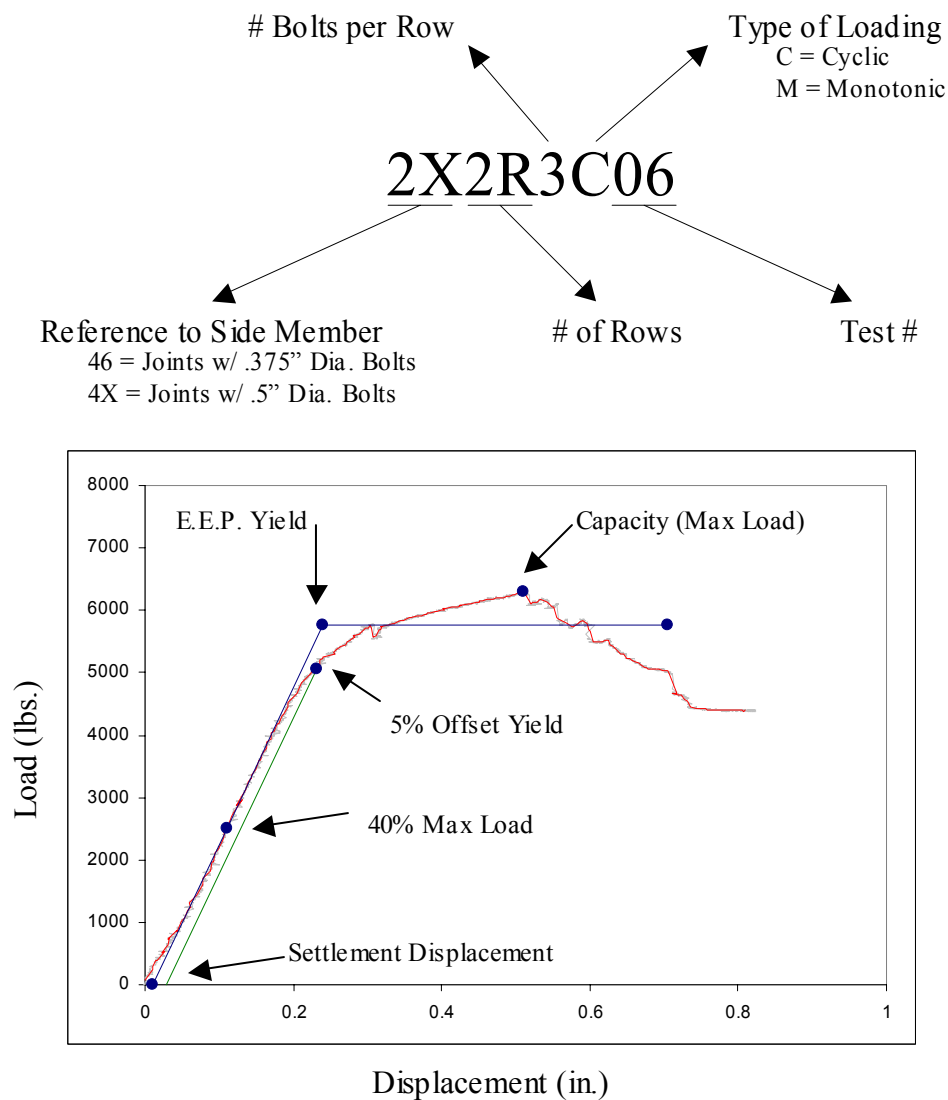


Figure A.1: Typical test identification and connection property definitions.

A.1.1 – 2X Series Monotonic

Table A.1: Connection and member properties, 2X1R1M Series.

Connection Properties 2X1R1M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	3216.18	3677.58	2696.15	3196.64	491.00	0.15
Displacement (in) =	1.05	0.95	0.76	0.92	0.15	0.16
Failure Load (lbs) =	2244.47	2868.95	2125.43	2412.95	399.37	0.17
Disp. @ Failure (in) =	1.14	0.96	0.86	0.99	0.14	0.14
40% Max (lbs) =	1279.83	1461.91	1072.50	1271.41	194.84	0.15
Displacement (in) =	0.22	0.18	0.19	0.20	0.02	0.11
Yield (lbs) =	2572.94	2942.06	2156.92	2557.31	392.80	0.15
Displacement (in) =	0.36	0.27	0.28	0.31	0.05	0.15
5% Offset Yield =	1437.52	1765.70	1334.87	1512.69	225.04	0.15
Displacement (in) =	0.26	0.23	0.24	0.24	0.02	0.08
Elastic Stiffness (lb/in) =	9573.07	16206.05	10912.25	12230.46	3507.48	0.29
Slack (in) =	0.09	0.09	0.09	0.09	0.00	0.03
Energy (lb*in) =	2340.45	2254.84	1451.26	2015.52	490.53	0.24
Ductility Ratio =	3.20	3.49	3.04	3.24	0.23	0.07
Yield Mode =	II	II	II			
Failure Mode =	Splitting	Splitting	Splitting			
Governing Member =	B	B	A			
Member Properties 2X1R1M Series						
Member A						
M.C. (%) =	11.49	10.86	11.74	11.36	0.45	0.04
S.G. =	0.51	0.64	0.52	0.56	0.07	0.13
D.E. 5% Yield (psi) =	5547.25	7721.72	6000.15	6423.04	1147.26	0.18
D.E. Capacity (psi) =	5659.43	7721.72	6000.15	6460.43	1105.51	0.17
Member B						
M.C. (%) =	10.31	12.96	11.38	11.55	1.33	0.12
S.G. =	0.57	0.59	0.59	0.58	0.01	0.02
D.E. 5% Yield (psi) =	6133.51	6167.78	6417.50	6239.60	155.02	0.02
D.E. Capacity (psi) =	6133.51	6176.81	6621.90	6310.74	270.34	0.04

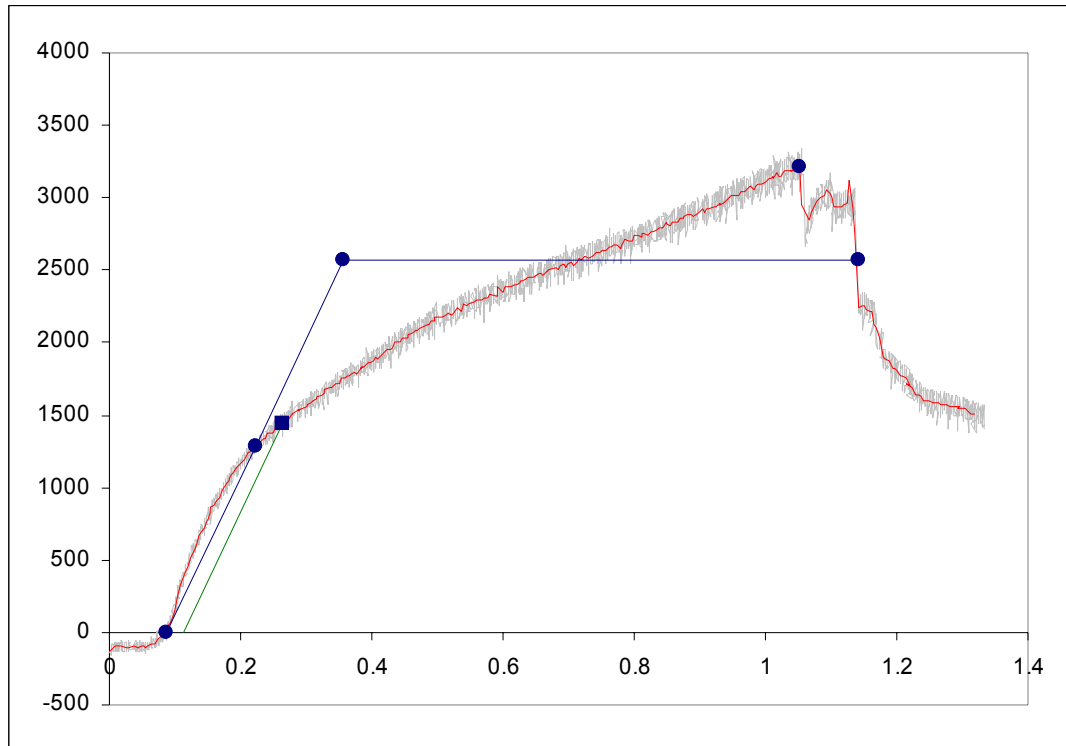


Figure A.2: Load (lbs) vs. Deflection (in.) plot. Test 2X1R1M01.

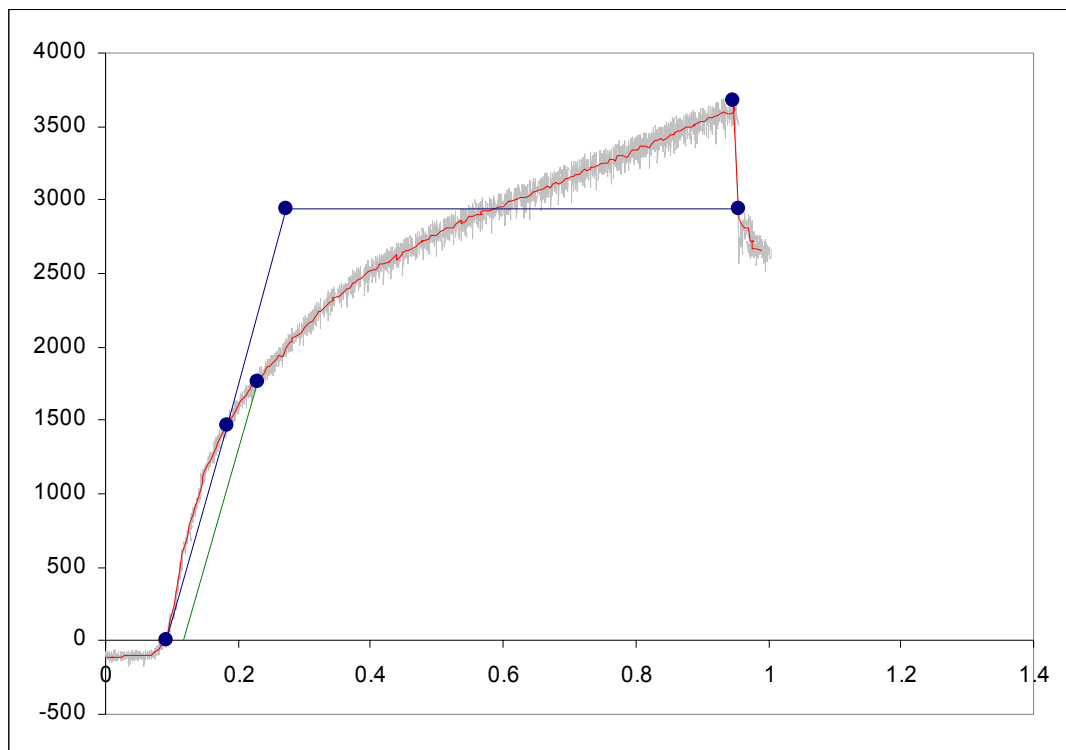


Figure A.3: Load (lbs) vs. Deflection (in.) plot. Test 2X1R1M02.

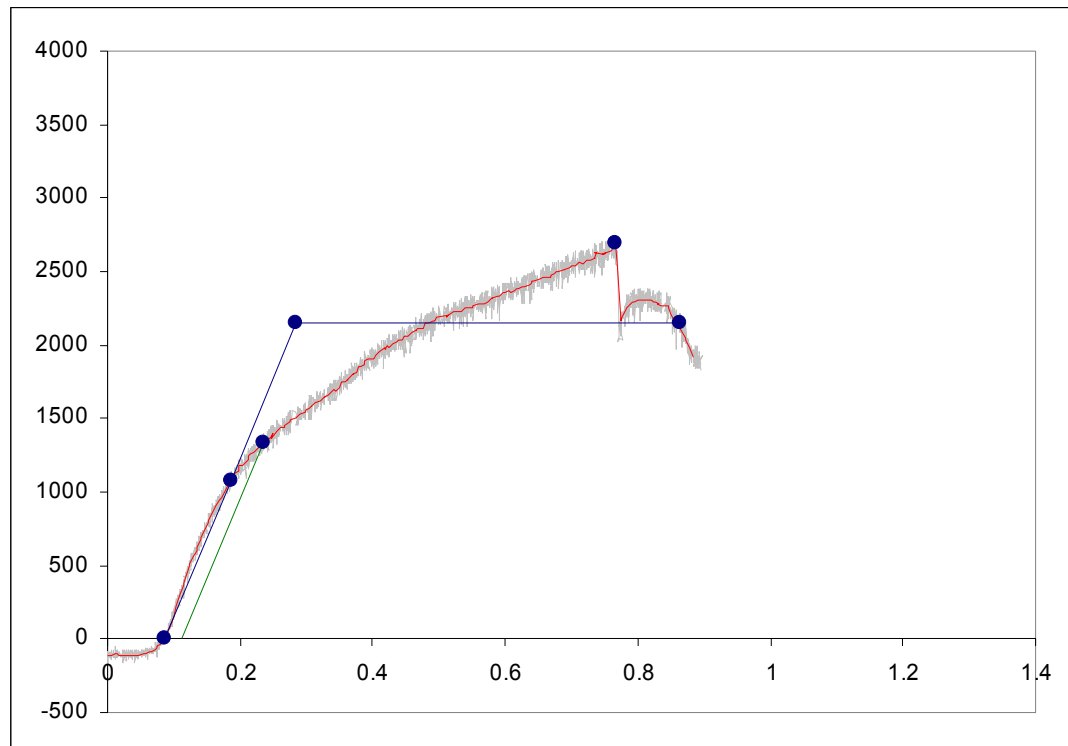


Figure A.4: Load (lbs) vs. Deflection (in.) plot. Test 2X1R1M03.

Table A.2: Connection and member properties, 2X1R5M Series.

Connection Properties 2X1R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	10348.16	8738.72	11100.50	10062.46	1206.53	0.12
Displacement (in) =	0.40	0.45	0.35	0.40	0.05	0.13
Failure Load (lbs) =	8263.37	7471.25	8809.75	8181.46	673.00	0.08
Disp. @ Failure (in) =	0.43	0.79	0.46	0.56	0.20	0.36
40% Max (lbs) =	4123.31	3479.54	4333.34	3978.73	444.88	0.11
Displacement (in) =	0.16	0.19	0.12	0.16	0.03	0.21
Yield (lbs) =	9719.56	8197.75	10364.86	9427.39	1112.71	0.12
Displacement (in) =	0.26	0.33	0.22	0.27	0.06	0.21
5% Offset Yield =	9304.15	7378.55	9444.56	8709.09	1154.42	0.13
Displacement (in) =	0.29	0.33	0.23	0.28	0.05	0.18
Elastic Stiffness (lb/in) =	52613.96	33323.39	64158.09	50031.81	15578.68	0.31
Slack (in) =	0.08	0.08	0.06	0.07	0.01	0.20
Energy (lb*in) =	2485.08	4773.46	3402.04	3553.53	1151.68	0.32
Ductility Ratio =	1.62	2.39	2.14	2.05	0.39	0.19
Yield Mode =	II	II	II			
Failure Mode =	Splitting	Splitting	Splitting			
Governing Member =	B	A	B			
Member Properties 2X1R5M Series						
Member A						
M.C. (%) =	11.31	12.28	11.11	11.57	0.63	0.05
S.G. =	0.71	0.51	0.63	0.62	0.10	0.16
D.E. 5% Yield (psi) =	7910.76	5682.79	7455.96	7016.50	1177.20	0.17
D.E. Capacity (psi) =	7978.49	5730.11	7628.62	7112.41	1209.82	0.17
Member B						
M.C. (%) =	11.82	12.84	14.33	13.00	1.26	0.10
S.G. =	0.70	0.54	0.64	0.63	0.08	0.13
D.E. 5% Yield (psi) =	7674.15	4571.89	5511.21	5919.08	1590.84	0.27
D.E. Capacity (psi) =	7674.15	4726.54	5595.17	5998.62	1514.65	0.25

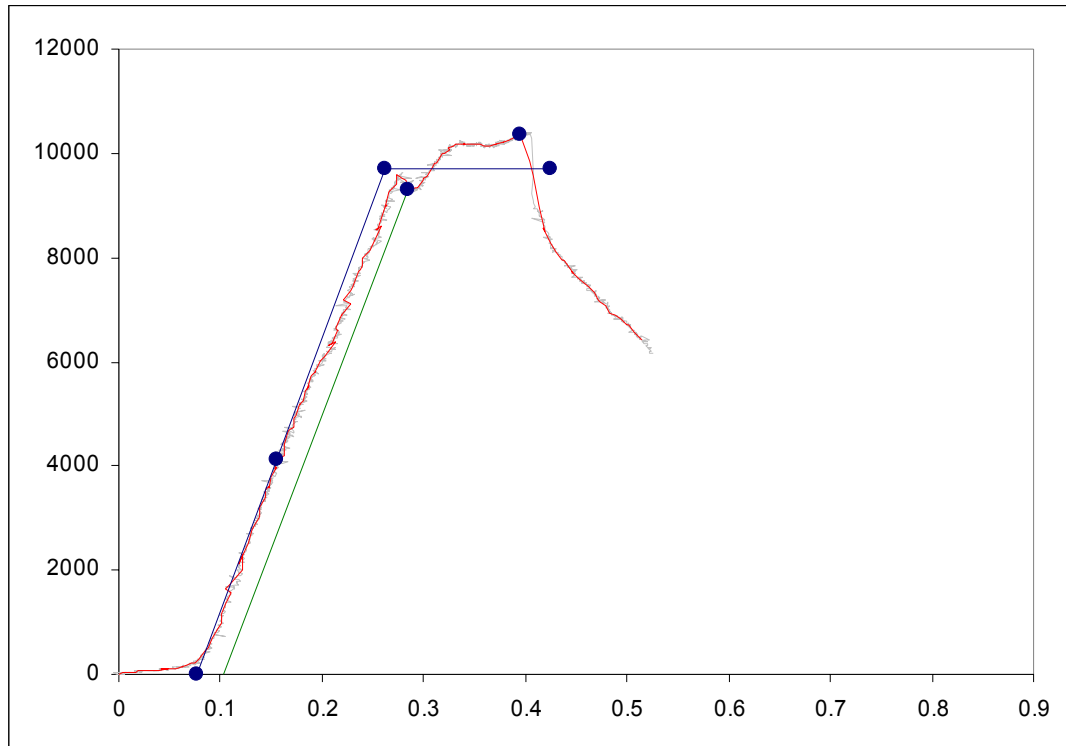


Figure A.5: Load (lbs) vs. Deflection (in.) plot. Test 2X1R5M01.

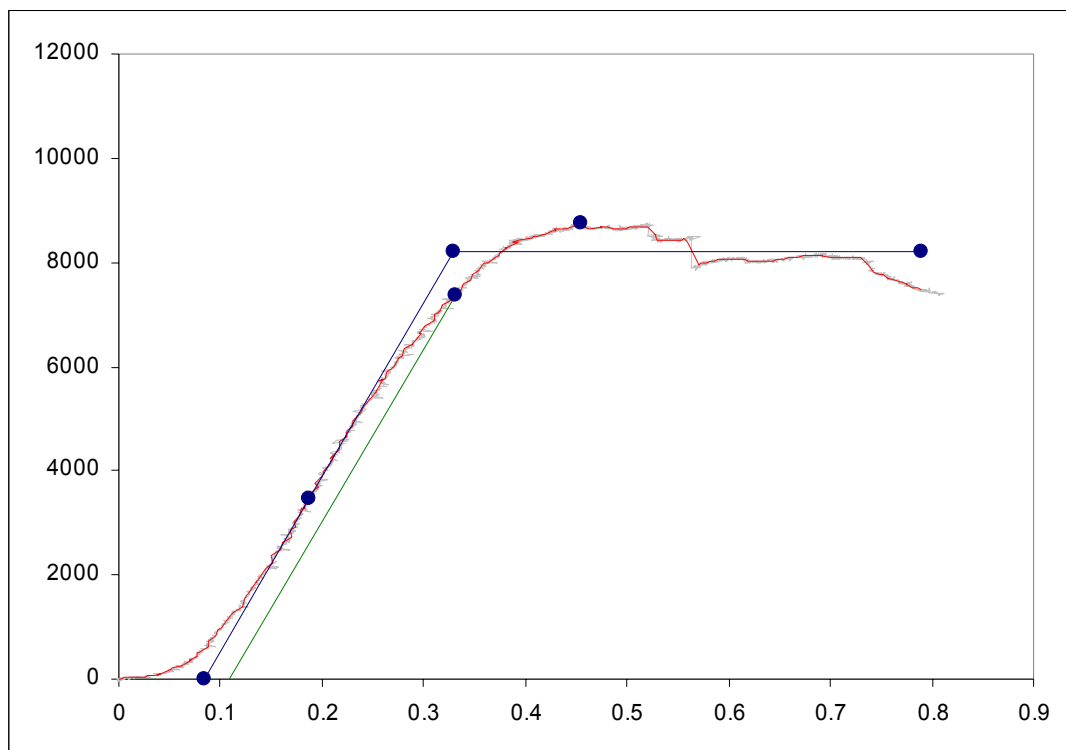


Figure A.6: Load (lbs) vs. Deflection (in.) plot. Test 2X1R5M02.

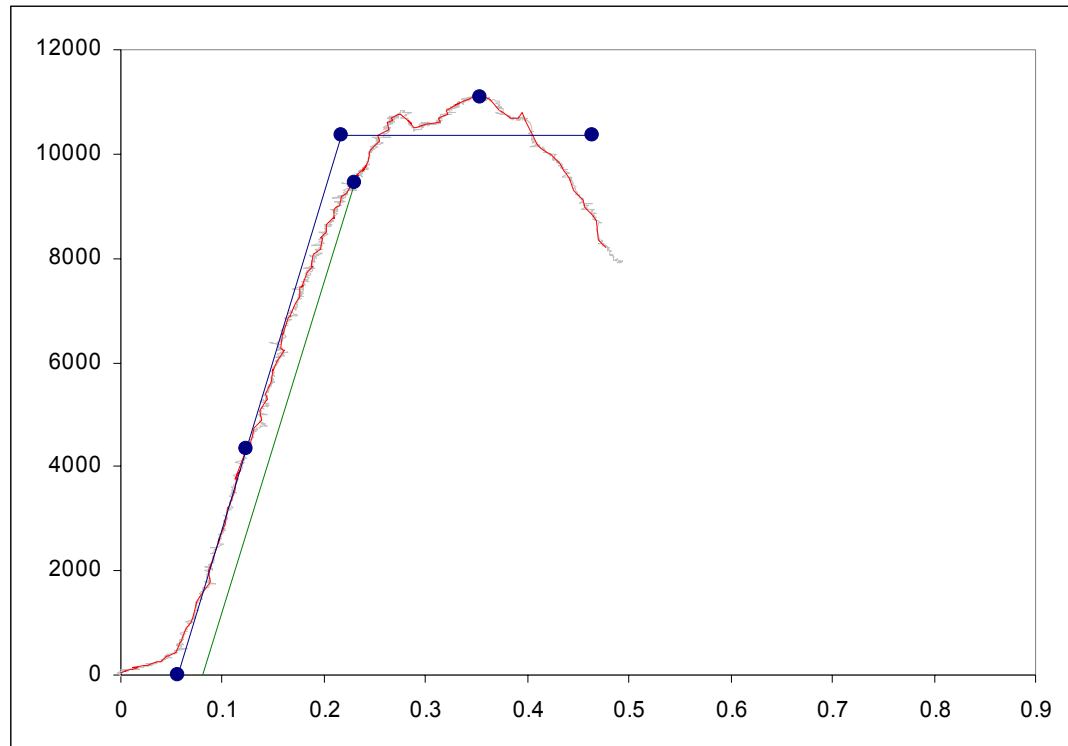


Figure A.7: Load (lbs) vs. Deflection (in.) plot. Test 2X1R5M03.

Table A.3: Connection and member properties, 2X2R5M Series.

Connection Properties 2X2R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	16681.10	14517.94	19608.99	16936.01	2555.08	0.15
Displacement (in) =	0.22	0.29	0.33	0.28	0.05	0.19
Failure Load (lbs) =	11879.97	2630.48	14607.65	9706.04	6277.55	0.65
Disp. @ Failure (in) =	0.23	0.35	0.34	0.31	0.07	0.21
40% Max (lbs) =	6397.40	5786.11	7817.80	6667.10	1042.35	0.16
Displacement (in) =	0.13	0.17	0.17	0.16	0.02	0.14
Yield (lbs) =	16352.16	11614.35	17970.19	15312.24	3303.07	0.22
Displacement (in) =	0.21	0.24	0.27	0.24	0.03	0.13
5% Offset Yield =	16681.10	14517.94	18266.00	16488.35	1881.45	0.11
Displacement (in) =	0.22	0.29	0.30	0.27	0.04	0.15
Elastic Stiffness (lb/in) =	124542.27	85185.66	101789.45	103839.12	19758.20	0.19
Slack (in) =	0.08	0.10	0.09	0.09	0.01	0.12
Energy (lb*in) =	1441.19	2035.27	2894.88	2123.78	730.88	0.34
Ductility Ratio =	1.11	1.47	1.27	1.28	0.18	0.14
Yield Mode =	II	II	II			
Failure Mode =	Rupture	Splitting	Splitting			
Governing Member =	A	B	B			
Member Properties 2X2R5M Series						
Member A						
M.C. (%) =	11.36	14.88	11.65	12.63	1.95	0.15
S.G. =	0.62	0.63	0.55	0.60	0.04	0.07
D.E. 5% Yield (psi) =	6605.64	6256.17	7108.52	6656.78	428.47	0.06
D.E. Capacity (psi) =	6605.64	6348.58	7108.52	6687.58	386.54	0.06
Member B						
M.C. (%) =	11.56	13.66	11.39	12.20	1.26	0.10
S.G. =	0.54	0.49	0.60	0.54	0.06	0.10
D.E. 5% Yield (psi) =		4344.99	6212.49	5278.74	1320.52	0.25
D.E. Capacity (psi) =		4356.48	6432.44	5394.46	1467.93	0.27

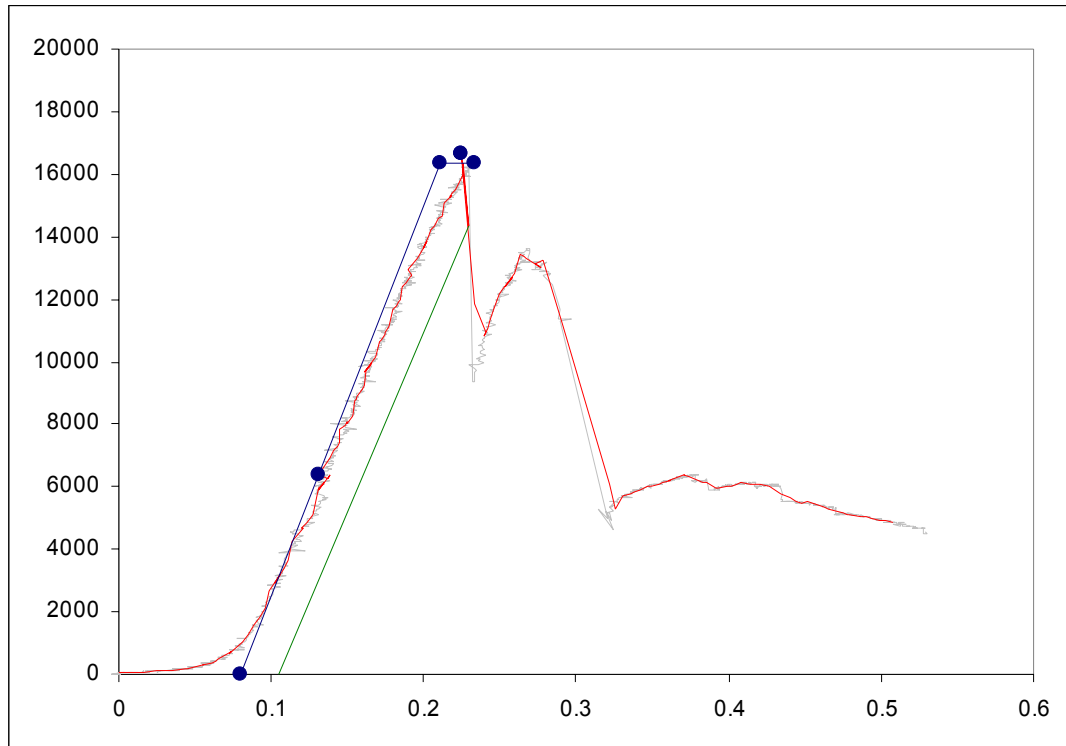


Figure A.8: Load (lbs) vs. Deflection (in.) plot. Test 2X2R5M01.

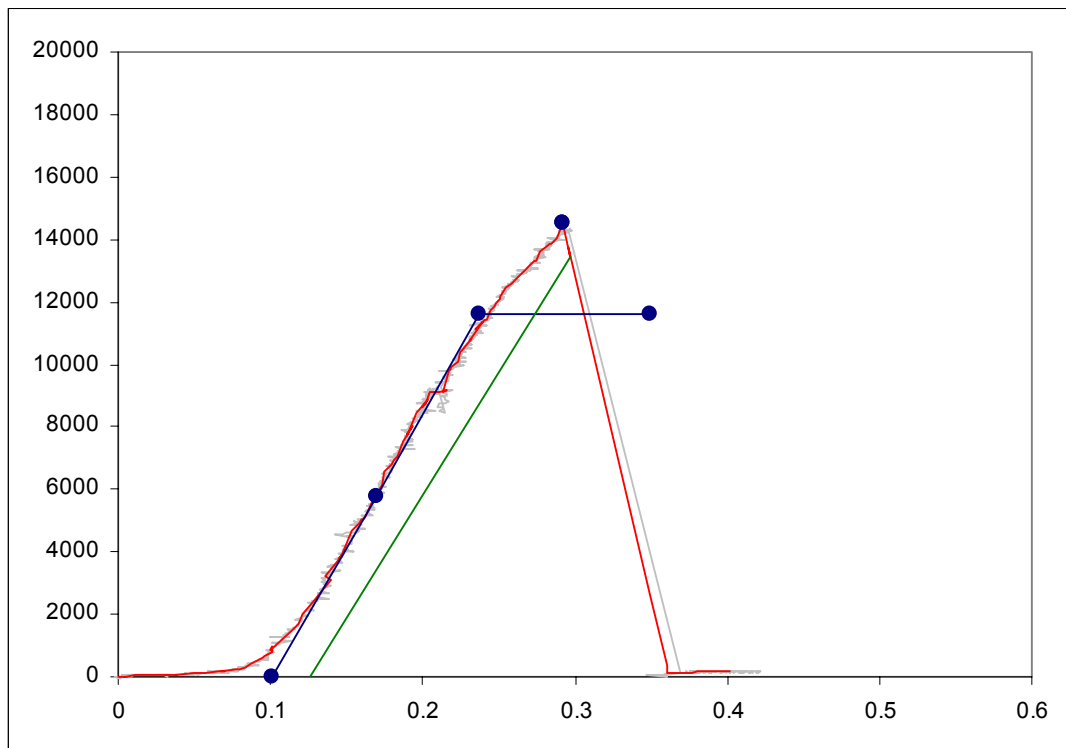


Figure A.9: Load (lbs) vs. Deflection (in.) plot. Test 2X2R5M02.

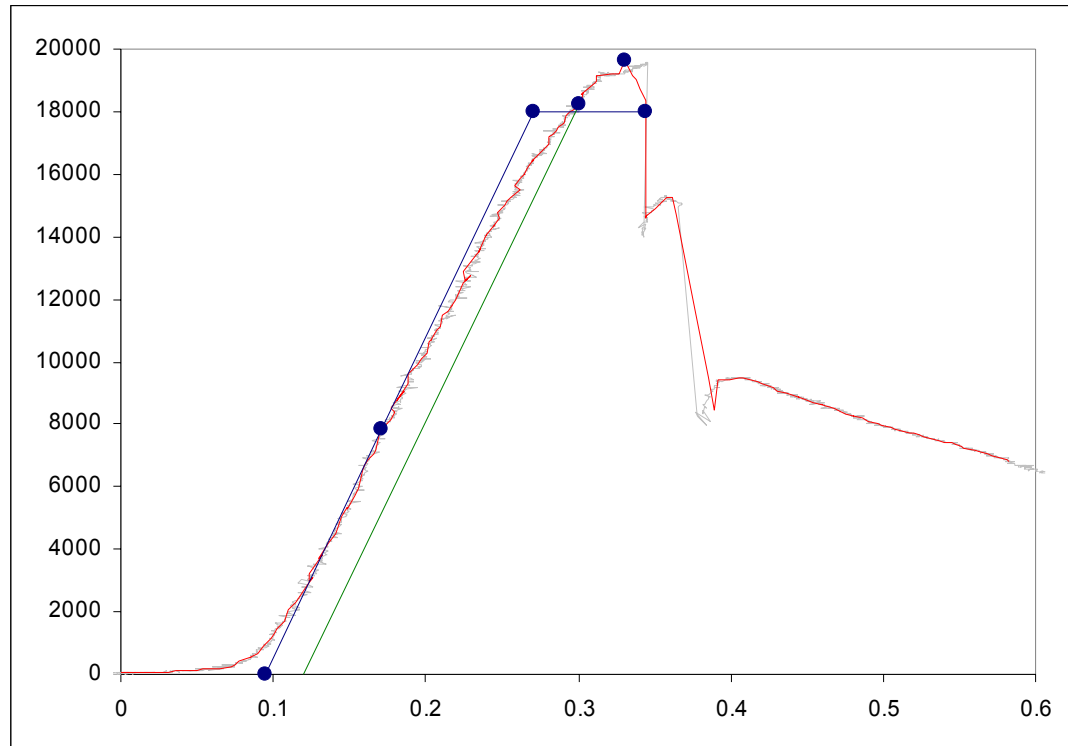


Figure A.10: Load (lbs) vs. Deflection (in.) plot. Test 2X2R5M03.

A.1.2 – ST Series Monotonic

Table A.4: Connection and member properties, ST1R1M Series.

Connection Properties ST1R1M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	3093.91	3746.77	3978.63	3606.43	458.75	0.13
Displacement (in) =	1.24	1.38	1.45	1.36	0.11	0.08
Failure Load (lbs) =	3093.91	3472.06	3592.42	3386.13	260.13	0.08
Disp. @ Failure (in) =	1.24	1.45	1.54	1.41	0.15	0.11
40% Max (lbs) =	1184.34	1459.10	1547.19	1396.88	189.26	0.14
Displacement (in) =	0.13	0.18	0.11	0.14	0.04	0.28
Yield (lbs) =	2553.77	2997.41	3210.21	2920.46	334.92	0.11
Displacement (in) =	0.25	0.28	0.22	0.25	0.03	0.12
5% Offset Yield =	1594.63	1716.75	1954.08	1755.16	182.77	0.10
Displacement (in) =	0.19	0.22	0.15	0.19	0.03	0.17
Elastic Stiffness (lb/in) =	11093.62	15741.64	14624.97	13820.08	2426.30	0.18
Slack (in) =	0.02	0.09	0.00	0.04	0.05	1.23
Energy (lb*in) =	2820.16	3703.78	4580.51	3701.48	880.18	0.24
Ductility Ratio =	4.90	5.16	6.99	5.68	1.14	0.20
Yield Mode =	IV	IV	IV			
Failure Mode =	N.A.	Splitting	Splitting			
Governing Member =	N.A.	N.A.	N.A.			
Member Properties ST1R1M Series						
Member A						
M.C. (%) =	14.47	14.32	15.81	14.87	0.82	0.06
S.G. =	0.40	0.41	0.57	0.46	0.10	0.21
D.E. 5% Yield (psi) =	4434.90	3746.99	4670.78	4284.23	479.98	0.11
D.E. Capacity (psi) =	4867.62	3849.39	4773.21	4496.74	562.60	0.13

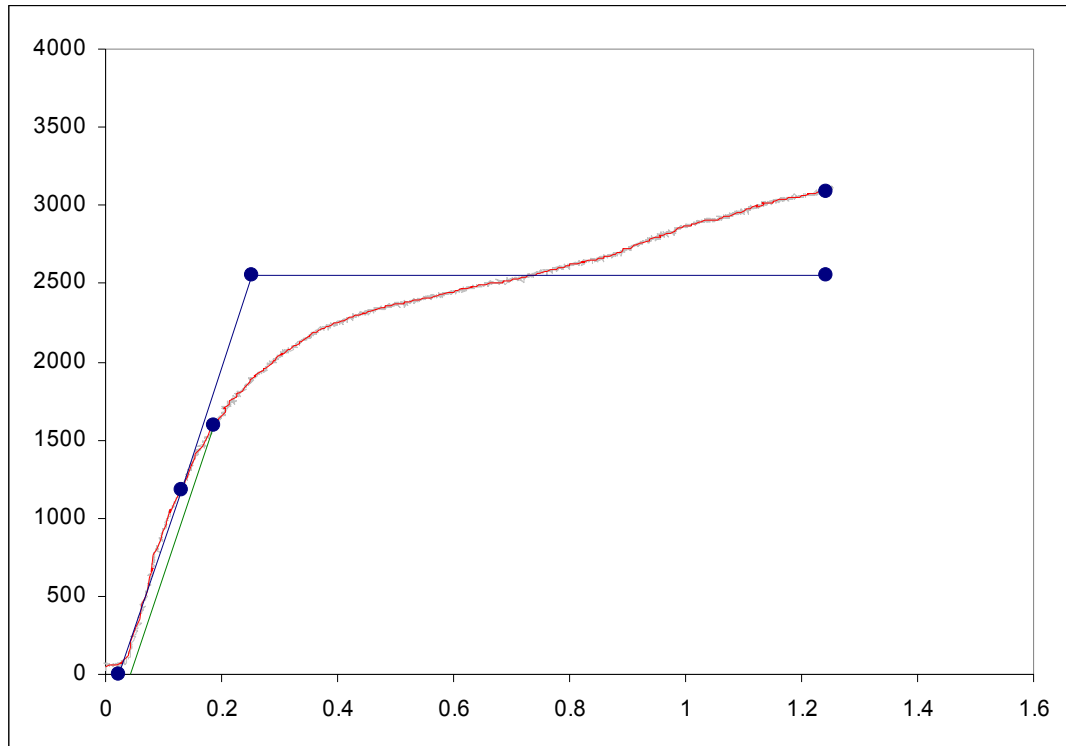


Figure A.11: Load (lbs) vs. Deflection (in.) plot. Test ST1R1M01.

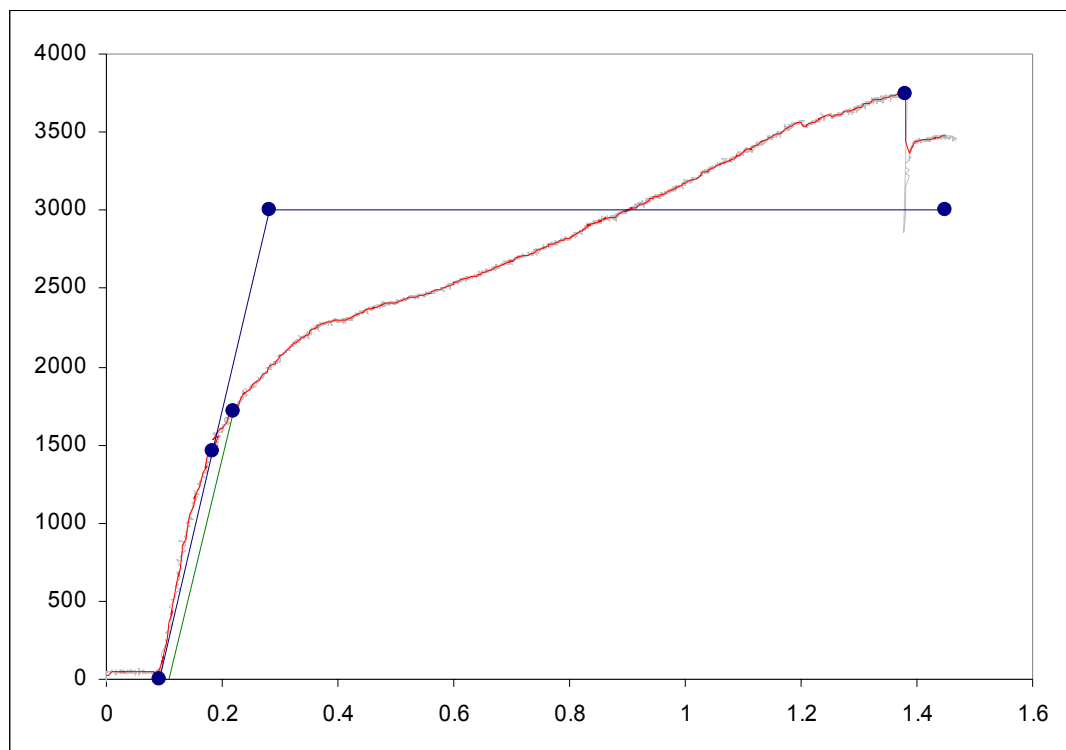


Figure A.12: Load (lbs) vs. Deflection (in.) plot. Test ST1R1M02.

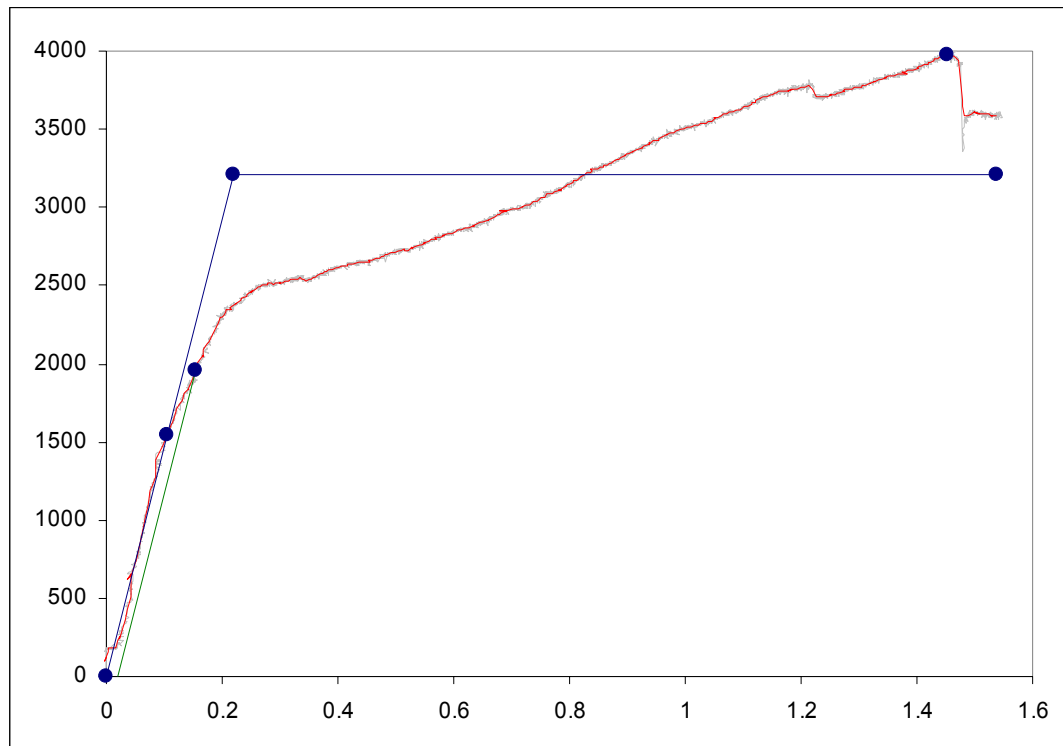


Figure A.13: Load (lbs) vs. Deflection (in.) plot. Test ST1R1M03.

Table A.5: Connection and member properties, ST1R5M Series.

Connection Properties ST1R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	8733.73	11045.98	7646.32	9142.01	1736.21	0.19
Displacement (in) =	0.18	0.30	0.20	0.23	0.06	0.28
Failure Load (lbs) =	6883.36	6722.11	6100.40	6568.62	413.43	0.06
Disp. @ Failure (in) =	0.36	0.31	0.30	0.32	0.03	0.10
40% Max (lbs) =	3404.10	4357.71	2944.90	3568.90	720.68	0.20
Displacement (in) =	0.04	0.07	0.07	0.06	0.02	0.26
Yield (lbs) =	7607.42	9608.21	7436.15	8217.26	1207.64	0.15
Displacement (in) =	0.11	0.17	0.15	0.14	0.03	0.21
5% Offset Yield =	7115.70	8150.35	6177.05	7147.70	987.04	0.14
Displacement (in) =	0.12	0.16	0.14	0.14	0.02	0.15
Elastic Stiffness (lb/in) =	62163.37	53583.75	54734.40	56827.17	4656.96	0.08
Slack (in) =	-0.01	-0.01	0.01	0.00	0.01	3.73
Energy (lb*in) =	2361.05	2234.57	1612.18	2069.27	400.87	0.19
Ductility Ratio =	2.90	1.84	2.01	2.25	0.57	0.25
Yield Mode =	III	II, IV	II, IV			
Failure Mode =	Splitting	Splitting	Splitting			
Governing Member =	N.A.	N.A.	N.A.			
Member Properties ST1R5M Series						
Member A						
M.C. (%) =	18.01	15.77	14.99	16.26	1.57	0.10
S.G. =	0.63	0.56	0.48	0.56	0.08	0.13
D.E. 5% Yield (psi) =	5147.31	4994.63	4004.34	4715.43	620.53	0.13
D.E. Capacity (psi) =	5644.58	5343.55	4205.64	5064.59	758.95	0.15

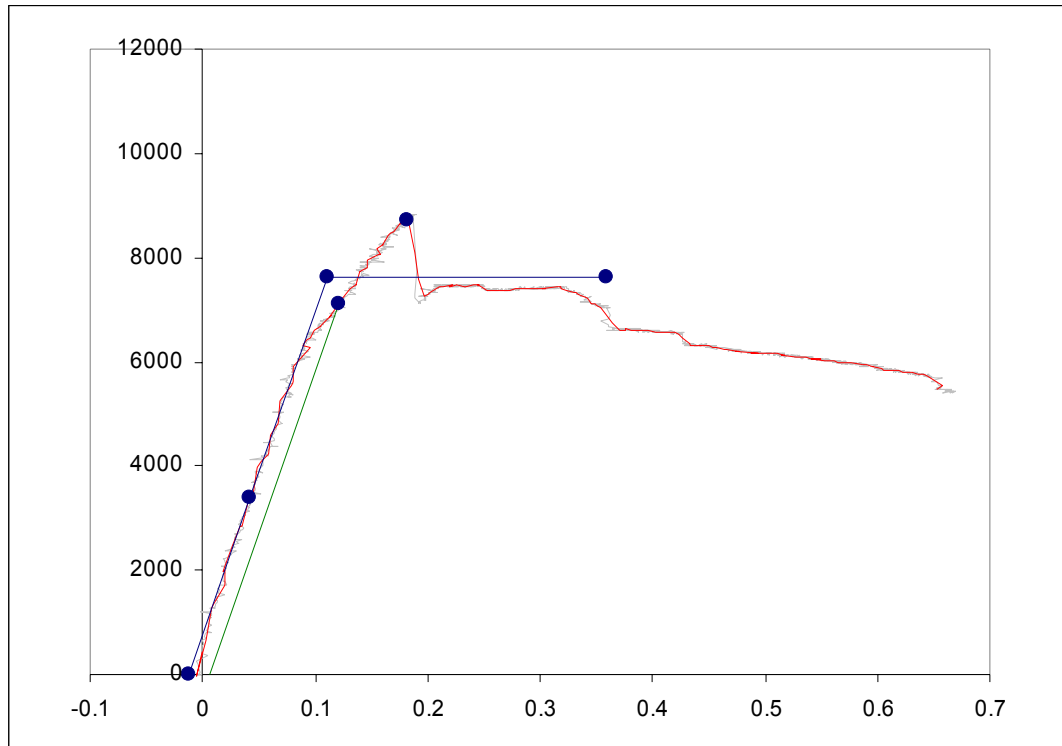


Figure A.14: Load (lbs) vs. Deflection (in.) plot. Test ST1R5M01.

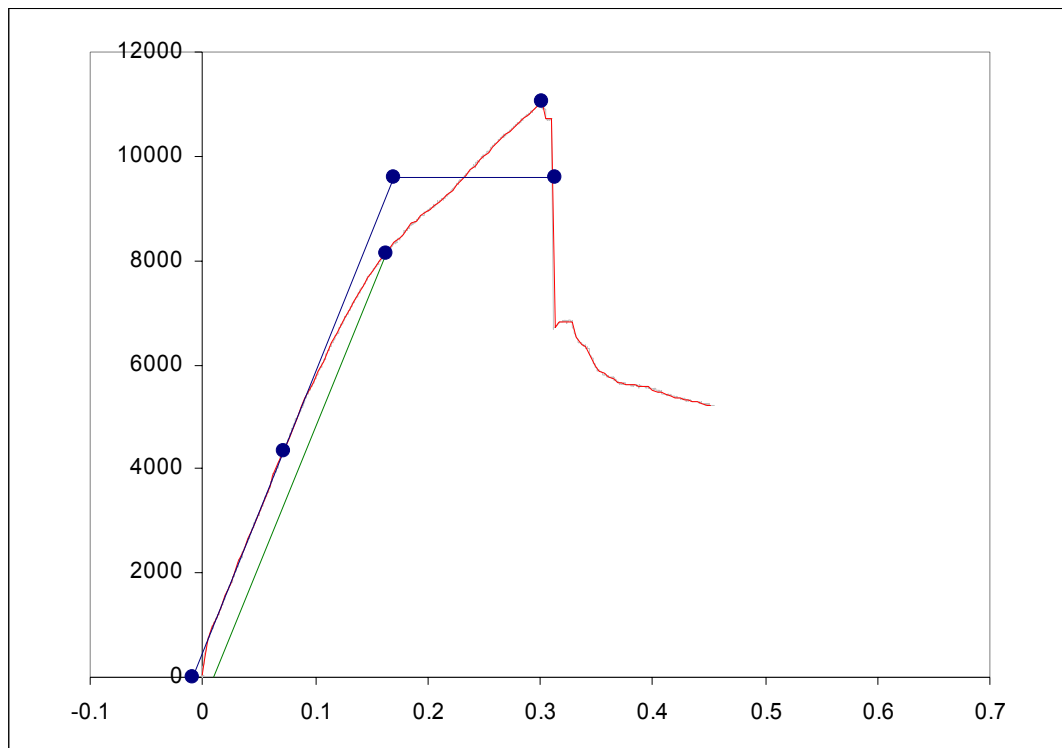


Figure A.15: Load (lbs) vs. Deflection (in.) plot. Test ST1R5M02.

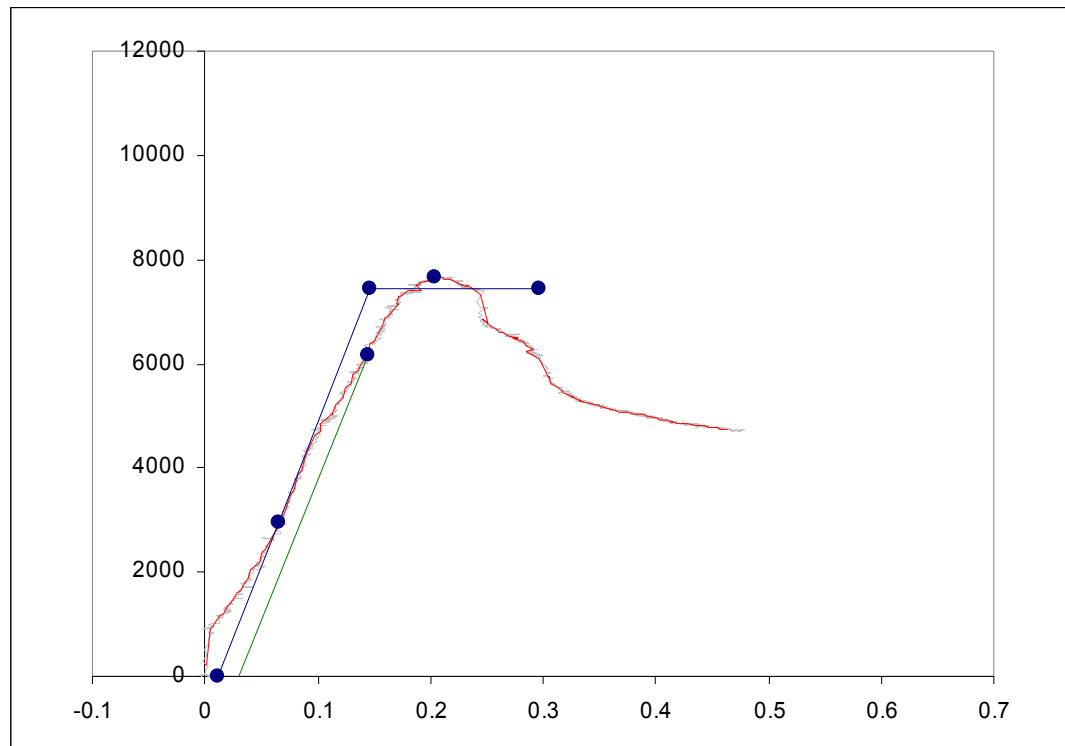


Figure A.16: Load (lbs) vs. Deflection (in.) plot. Test ST1R5M03.

Table A.6: Connection and member properties, ST2R5M Series.

Connection Properties ST2R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	24890.64	21160.66	17575.37	21208.89	3657.87	0.17
Displacement (in) =	0.31	0.32	0.37	0.34	0.03	0.10
Failure Load (lbs) =	21659.22	16842.70	6268.49	14923.47	7872.82	0.53
Disp. @ Failure (in) =	0.38	0.59	0.43	0.47	0.11	0.23
40% Max (lbs) =	9900.02	8248.70	6960.42	8369.71	1473.53	0.18
Displacement (in) =	0.11	0.12	0.13	0.12	0.01	0.11
Yield (lbs) =	23160.69	19917.87	15978.42	19685.66	3596.76	0.18
Displacement (in) =	0.25	0.26	0.26	0.26	0.01	0.04
5% Offset Yield =	23296.32	19522.19	13916.19	18911.57	4719.78	0.25
Displacement (in) =	0.27	0.28	0.25	0.27	0.01	0.05
Elastic Stiffness (lb/in) =	95028.95	78570.93	68818.81	80806.23	13247.27	0.16
Slack (in) =	0.00	0.01	0.03	0.01	0.01	1.03
Energy (lb*in) =	5899.82	9156.48	4549.88	6535.40	2368.16	0.36
Ductility Ratio =	1.54	2.22	1.64	1.80	0.37	0.20
Yield Mode =	IV	IV	II,IV			
Failure Mode =	Blk. Shear	Splitting	Blk. Shear			
Governing Member =	N.A.	N.A.	N.A.			
Member Properties ST2R5M Series						
Member A						
M.C. (%) =	12.74	15.90	14.03	14.22	1.59	0.11
S.G. =	0.56	0.49	0.38	0.48	0.09	0.19
D.E. 5% Yield (psi) =	6292.60	4004.18	3157.74	4484.84	1621.76	0.36
D.E. Capacity (psi) =	7032.36	4202.76	3237.32	4824.14	1972.35	0.41

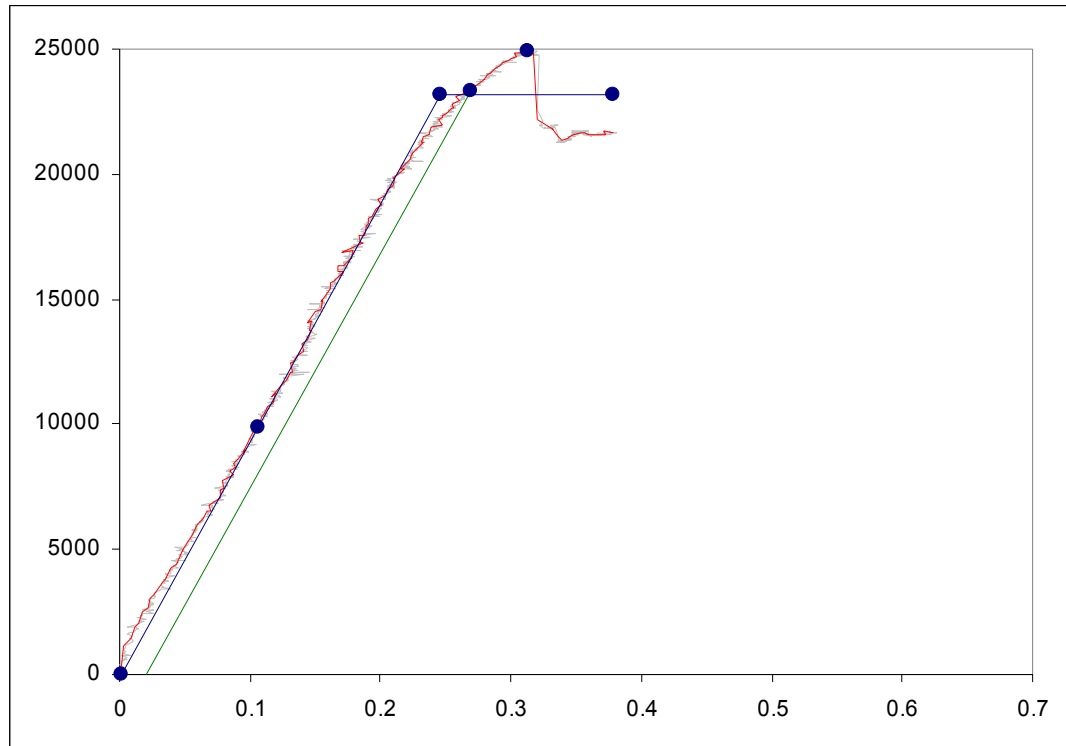


Figure A.17: Load (lbs) vs. Deflection (in.) plot. Test ST2R5M01.

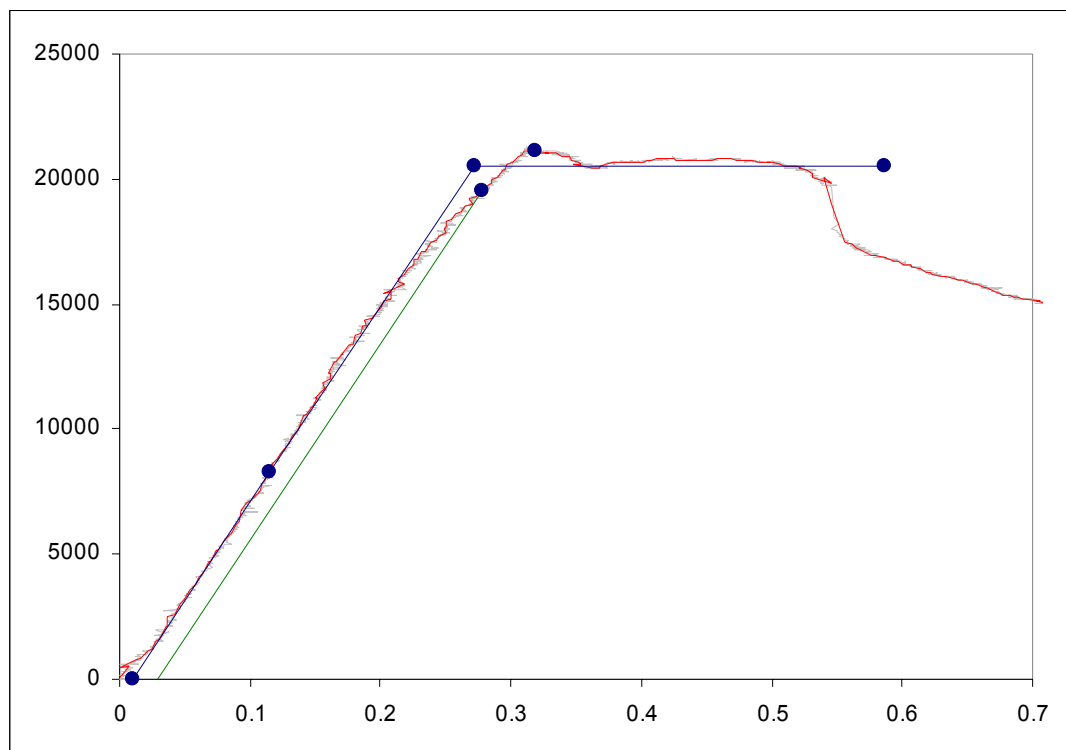


Figure A.18: Load (lbs) vs. Deflection (in.) plot. Test ST2R5M02.

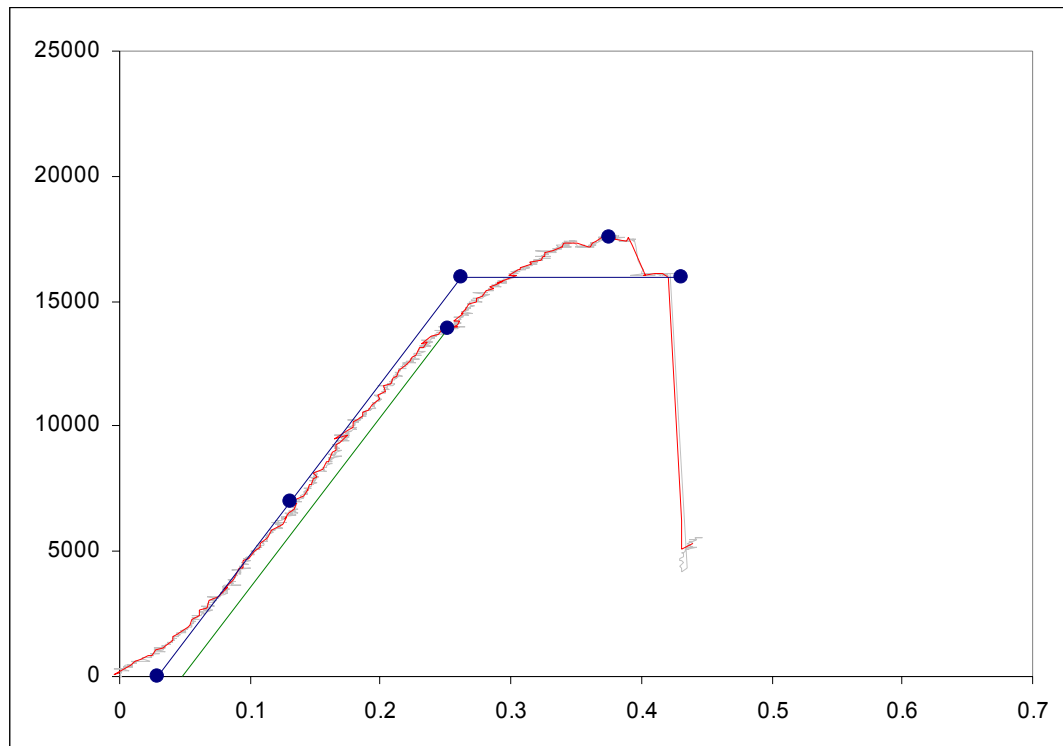


Figure A.19: Load (lbs) vs. Deflection (in.) plot. Test ST2R5M03.

A.1.3 – 46 Series Monotonic

Table A.7: Connection and member properties, 461R1M Series.

Connection Properties 461R1M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	2384.25	2493.83	2221.37	2366.48	137.10	0.06
Displacement (in) =	1.52	1.54	1.57	1.54	0.02	0.02
Failure Load (lbs) =	2384.25	2493.83	2221.37	2366.48	137.10	0.06
Disp. @ Failure (in) =	1.52	1.54	1.57	1.54	0.02	0.02
40% Max (lbs) =	936.46	997.33	845.32	926.37	76.51	0.08
Displacement (in) =	0.22	0.21	0.15	0.19	0.04	0.20
Yield (lbs) =	1907.40	1995.06	1777.09	1893.19	109.68	0.06
Displacement (in) =	0.35	0.34	0.25	0.32	0.05	0.17
5% Offset Yield =	1136.69	1246.09	1047.88	1143.55	99.28	0.09
Displacement (in) =	0.26	0.26	0.19	0.24	0.04	0.17
Elastic Stiffness (lb/in) =	7367.71	7750.07	8858.86	7992.21	774.50	0.10
Slack (in) =	0.09	0.08	0.05	0.08	0.02	0.27
Energy (lb*in) =	2471.92	2550.44	2506.43	2509.59	39.36	0.02
Ductility Ratio =	4.33	4.50	6.18	5.01	1.02	0.20
Yield Mode =	IV	IV	IV			
Failure Mode =	N.A.	N.A.	N.A.			
Governing Member =	N.A.	N.A.	N.A.			
Member Properties 461R1M Series						
Member A						
M.C. (%) =	16.04	17.21	16.55	16.60	0.59	0.04
S.G. =	0.48	0.56	0.44	0.49	0.06	0.12
D.E. 5% Yield (psi) =	4315.36	4330.95	4223.43	4289.91	58.10	0.01
D.E. Capacity (psi) =	4862.65	4768.62	4507.65	4712.98	183.92	0.04
Member B						
M.C. (%) =	15.69	15.89	17.23	16.27	0.84	0.05
S.G. =	0.47	0.53	0.45	0.48	0.04	0.09
D.E. 5% Yield (psi) =	5697.37	4486.86	3966.36	4716.86	888.13	0.19
D.E. Capacity (psi) =	5924.35	5196.56	4458.04	5192.98	733.16	0.14

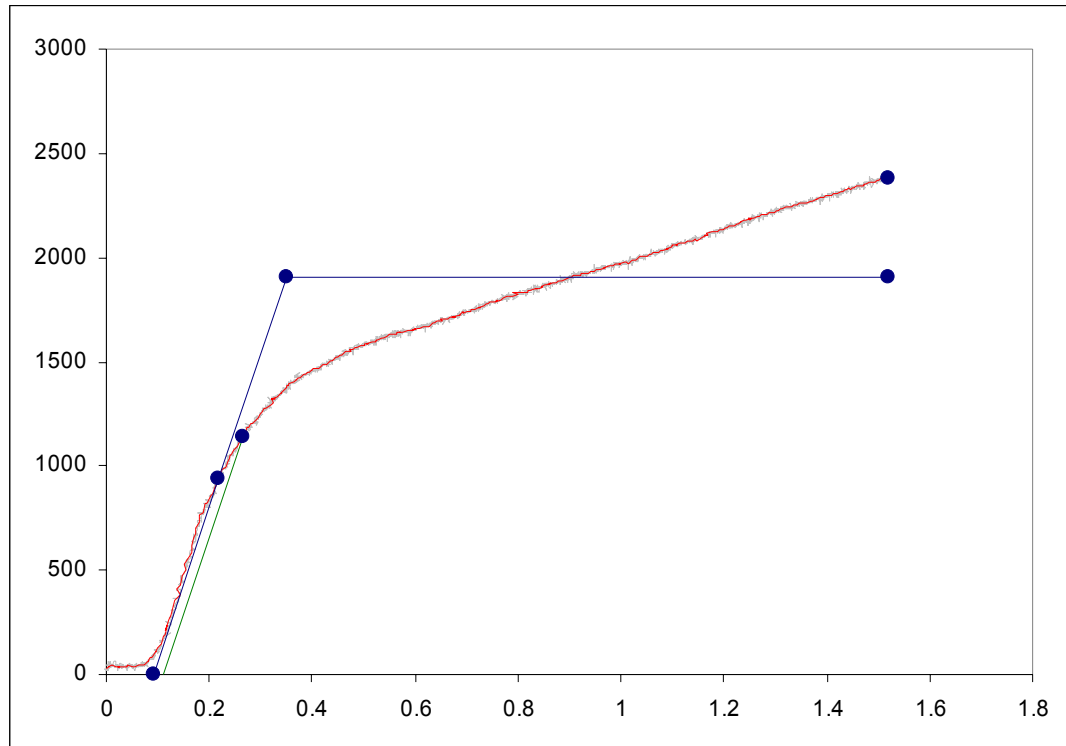


Figure A.20: Load (lbs) vs. Deflection (in.) plot. Test 461R1M01.

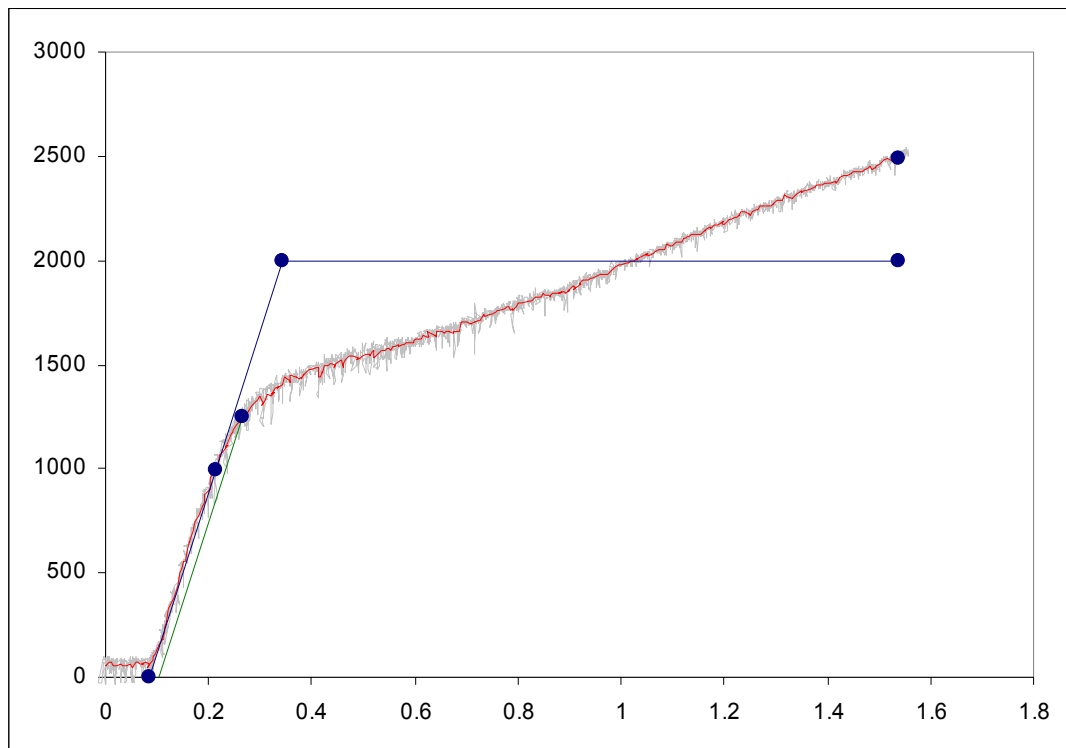


Figure A.21: Load (lbs) vs. Deflection (in.) plot. Test 461R1M02.

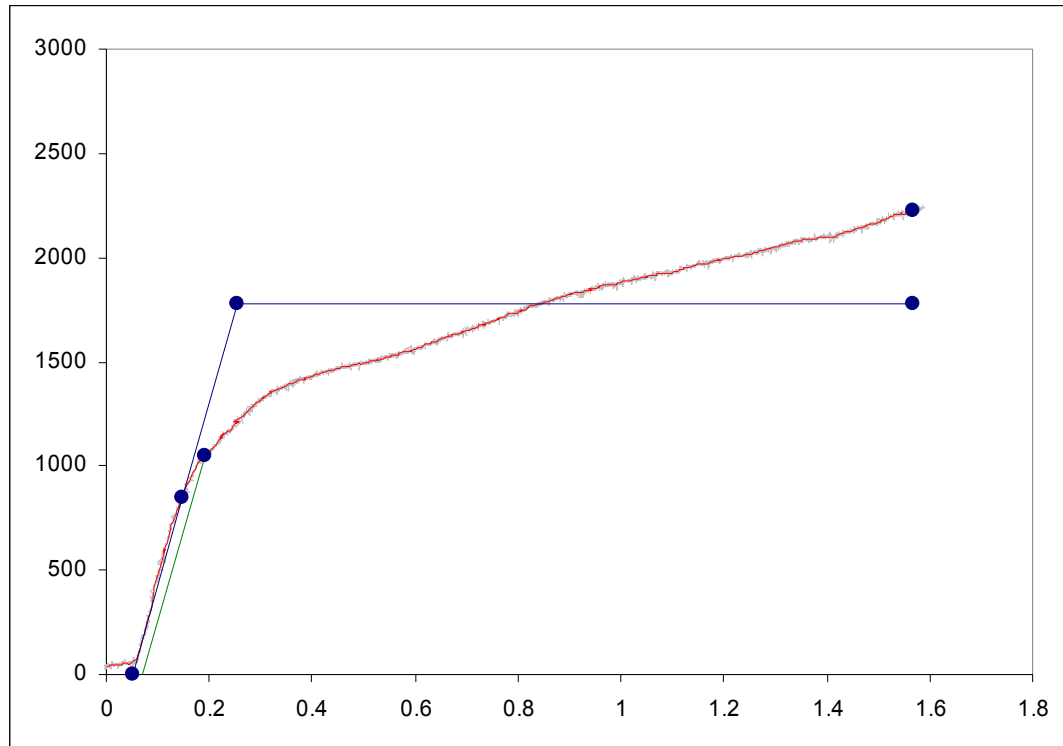


Figure A.22: Load (lbs) vs. Deflection (in.) plot. Test 461R1M03.

Table A.8: Connection and member properties, 461R5M Series.

Connection Properties 461R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	6290.55	7901.93	7542.91	7245.13	845.96	0.12
Displacement (in) =	0.51	0.50	0.42	0.48	0.05	0.10
Failure Load (lbs) =	5026.35	6302.79	5183.14	5504.09	696.12	0.13
Disp. @ Failure (in) =	0.70	0.79	0.54	0.68	0.12	0.18
40% Max (lbs) =	2515.39	2988.41	3011.34	2838.38	279.95	0.10
Displacement (in) =	0.11	0.11	0.10	0.11	0.01	0.05
Yield (lbs) =	5772.39	7330.96	7328.46	6810.60	899.12	0.13
Displacement (in) =	0.24	0.25	0.23	0.24	0.01	0.04
5% Offset Yield =	5067.23	6577.88	6103.99	5916.37	772.60	0.13
Displacement (in) =	0.23	0.24	0.21	0.23	0.02	0.07
Elastic Stiffness (lb/in) =	25136.54	30904.16	33769.04	29936.58	4396.84	0.15
Slack (in) =	0.01	0.01	0.01	0.01	0.00	0.06
Energy (lb*in) =	3342.17	4826.57	3114.00	3760.91	929.91	0.25
Ductility Ratio =	2.93	3.19	2.39	2.84	0.41	0.14
Yield Mode =	IV	IV	IV			
Failure Mode =	Splitting	Splitting	Splitting			
Governing Member =	B	A	B			
Member Properties 461R5M Series						
Member A						
M.C. (%) =	14.78	18.05	16.35	16.39	1.64	0.10
S.G. =	0.39	0.51	0.45	0.45	0.06	0.13
D.E. 5% Yield (psi) =	3918.82	3887.55	5028.85	4278.41	650.09	0.15
D.E. Capacity (psi) =	4221.54	4411.55	5504.13	4712.41	692.20	0.15
Member B						
M.C. (%) =	11.47	18.82	20.43	16.91	4.78	0.28
S.G. =	0.43	0.52	0.59	0.51	0.08	0.16
D.E. 5% Yield (psi) =	5319.19	4164.15	5126.77	4870.04	618.84	0.13
D.E. Capacity (psi) =	5814.67	4609.99	5620.57	5348.41	646.81	0.12

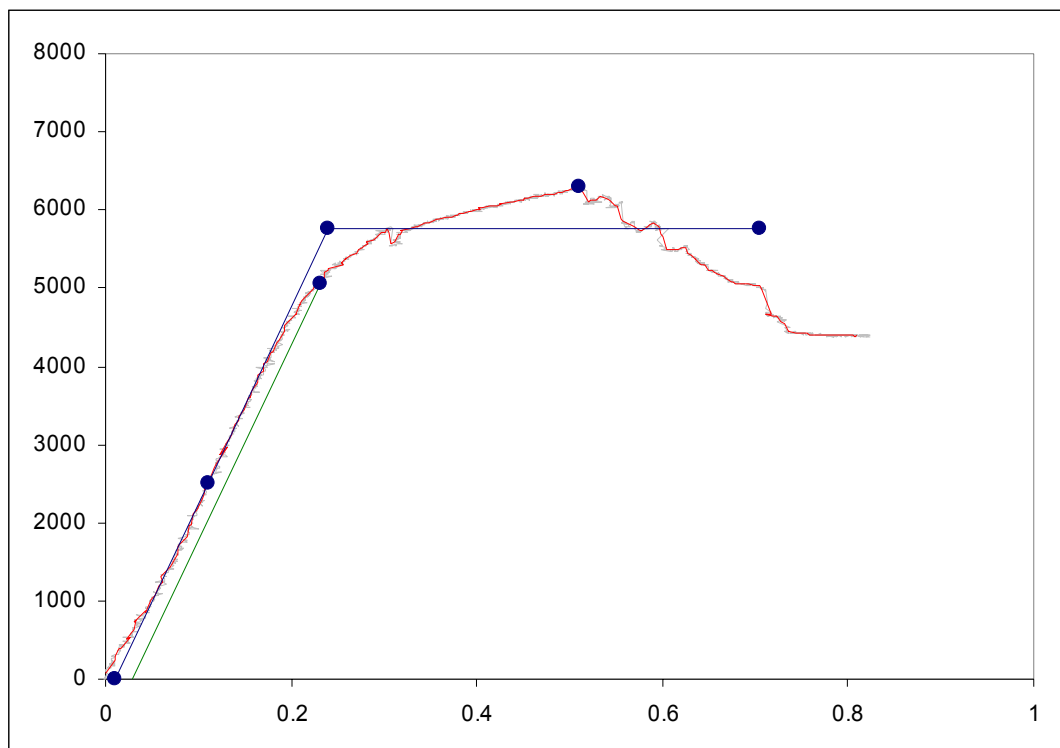


Figure A.23: Load (lbs) vs. Deflection (in.) plot. Test 461R5M01.

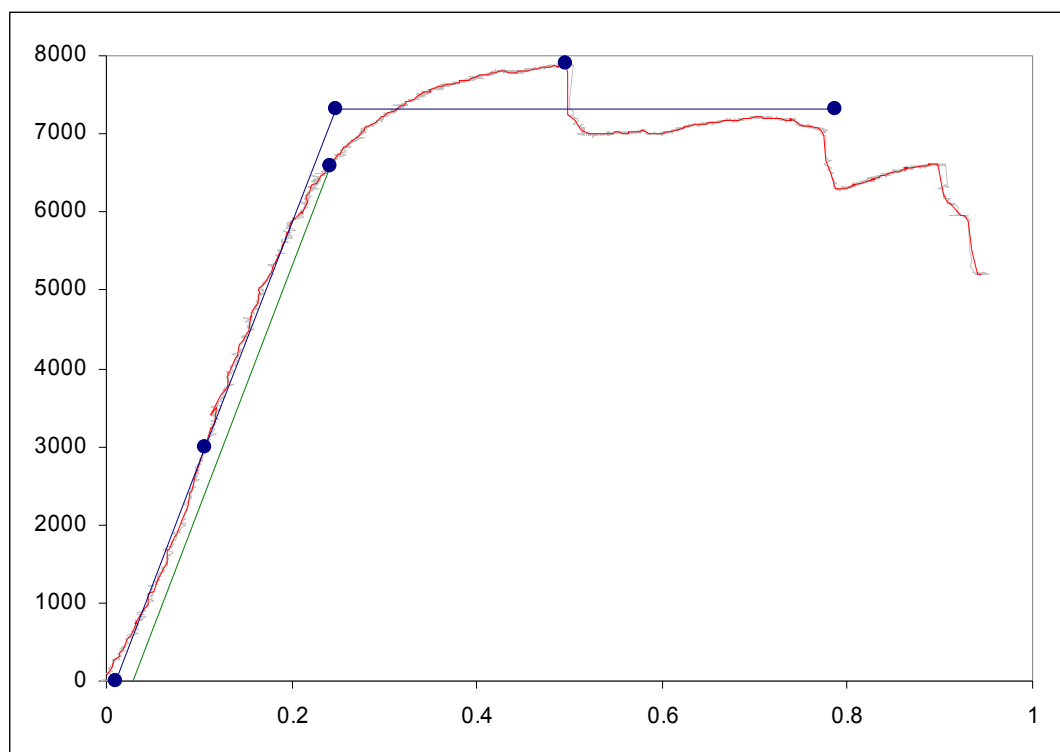


Figure A.24: Load (lbs) vs. Deflection (in.) plot. Test 461R5M02.

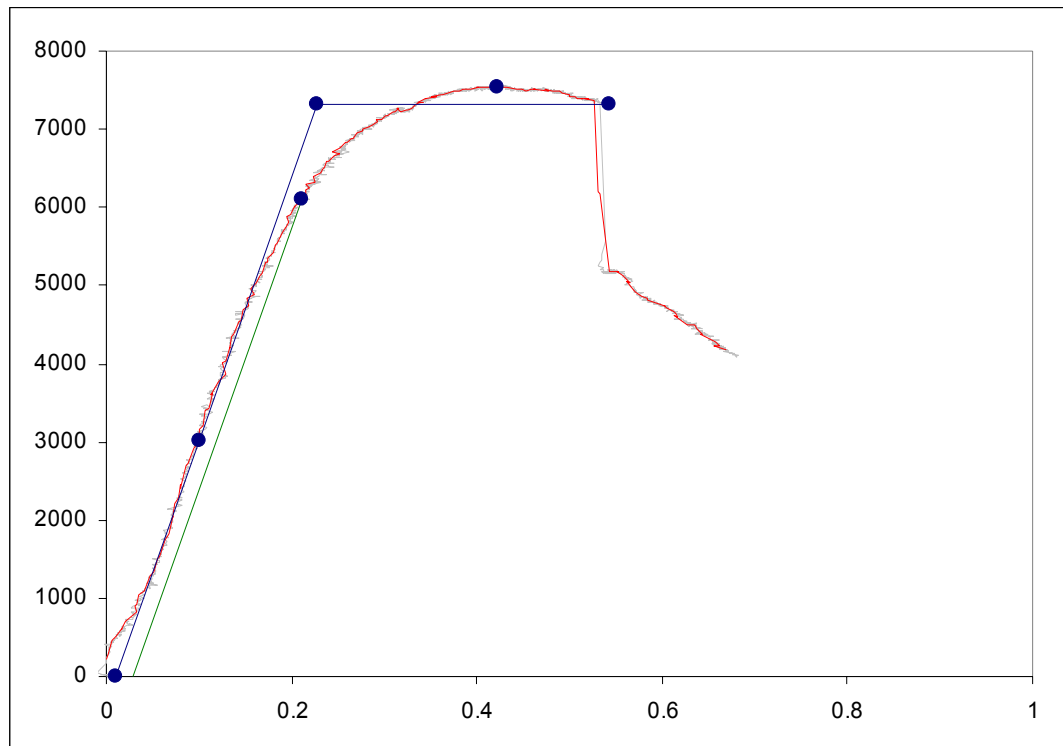


Figure A.25: Load (lbs) vs. Deflection (in.) plot. Test 461R5M03.

Table A.9: Connection and member properties, 462R5M Series.

Connection Properties 462R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	13206.32	14897.65	14641.75	14248.57	911.64	0.06
Displacement (in) =	0.51	0.35	0.53	0.47	0.10	0.21
Failure Load (lbs) =	7102.80	11715.17	11347.51	10055.16	2563.42	0.25
Disp. @ Failure (in) =	0.53	0.46	0.83	0.61	0.20	0.32
40% Max (lbs) =	5218.26	5797.61	5763.11	5592.99	324.99	0.06
Displacement (in) =	0.21	0.12	0.17	0.16	0.05	0.28
Yield (lbs) =	13206.32	14152.07	13830.17	13729.52	480.84	0.04
Displacement (in) =	0.42	0.25	0.33	0.33	0.09	0.27
5% Offset Yield =	11361.40	12657.87	12025.82	12015.03	648.30	0.05
Displacement (in) =	0.40	0.24	0.31	0.32	0.08	0.24
Elastic Stiffness (lb/in) =	37314.18	64204.84	49433.58	50317.54	13467.11	0.27
Slack (in) =	0.07	0.03	0.05	0.05	0.02	0.45
Energy (lb*in) =	3758.85	4594.74	8834.86	5729.48	2721.62	0.48
Ductility Ratio =	1.25	1.87	2.52	1.88	0.63	0.34
Yield Mode =	IV	IV	IV			
Failure Mode =	Rupture	Splitting	Splitting			
Governing Member =	A	Both	Both			
Member Properties 462R5M Series						
Member A						
M.C. (%) =	15.65	16.12	15.70	15.82	0.26	0.02
S.G. =	0.34	0.60	0.48	0.47	0.13	0.27
D.E. 5% Yield (psi) =	3657.99	5294.98	4660.28	4537.75	825.35	0.18
D.E. Capacity (psi) =	4023.35	5789.58	4983.37	4932.10	884.23	0.18
Member B						
M.C. (%) =	14.78	13.68	14.67	14.38	0.61	0.04
S.G. =	0.48	0.73	0.57	0.59	0.13	0.21
D.E. 5% Yield (psi) =	3892.50	5033.50	4748.32	4558.11	593.81	0.13
D.E. Capacity (psi) =	4600.90	5466.76	5233.66	5100.44	448.04	0.09

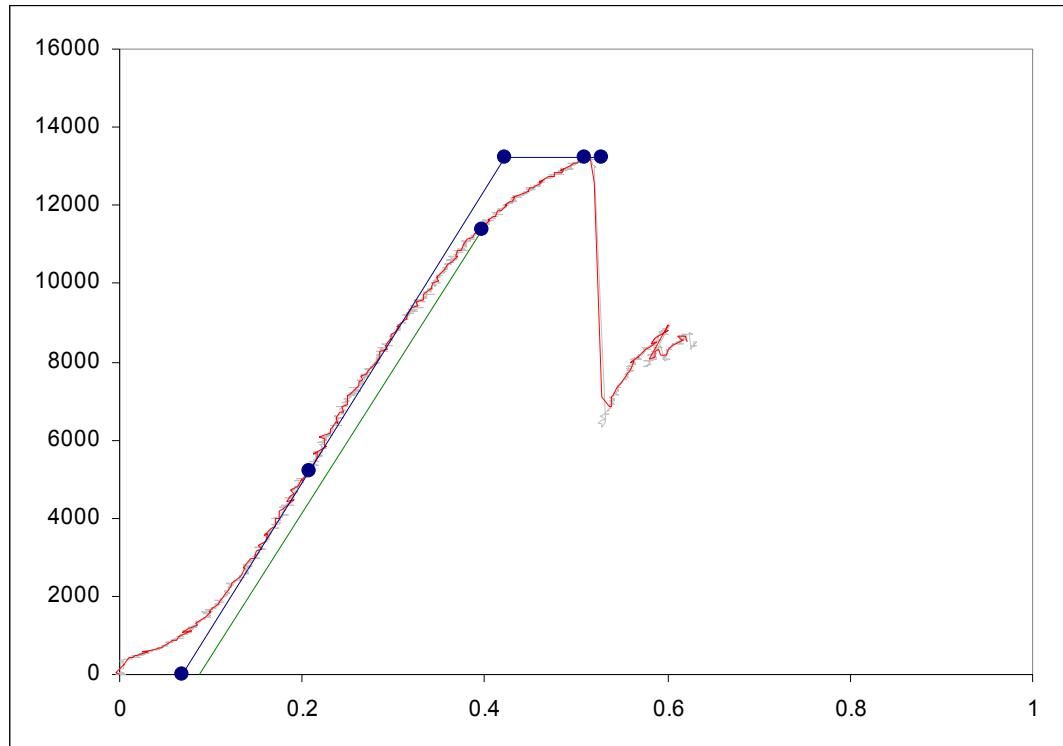


Figure A.26: Load (lbs) vs. Deflection (in.) plot. Test 462R5M01.

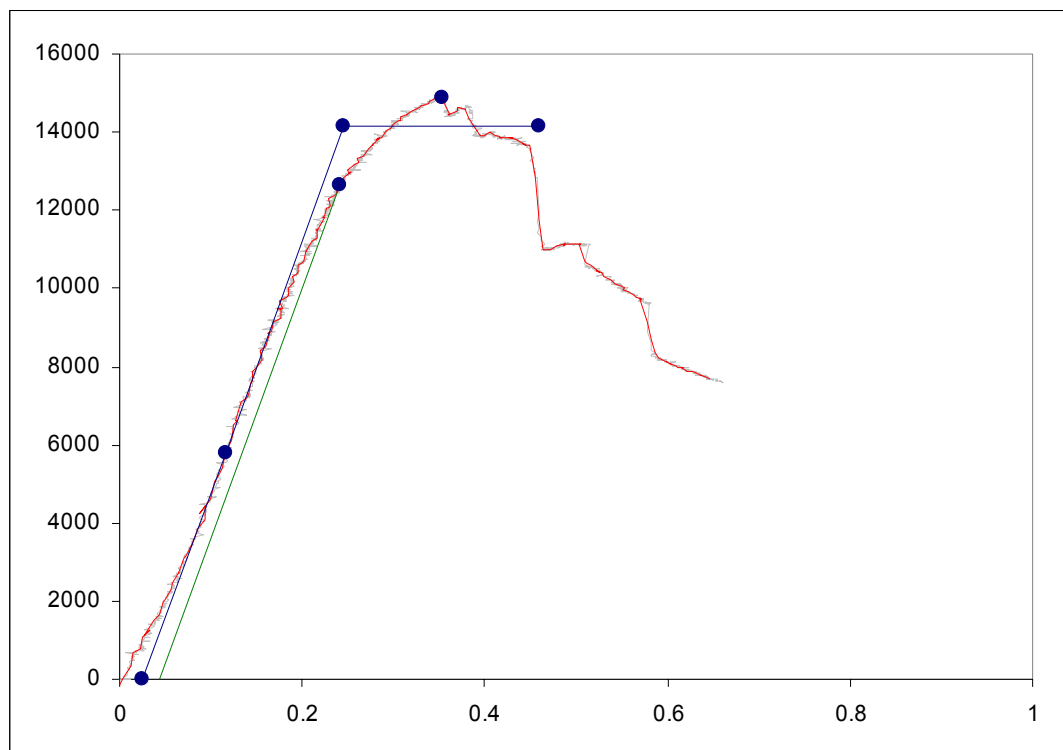


Figure A.27: Load (lbs) vs. Deflection (in.) plot. Test 462R5M02.

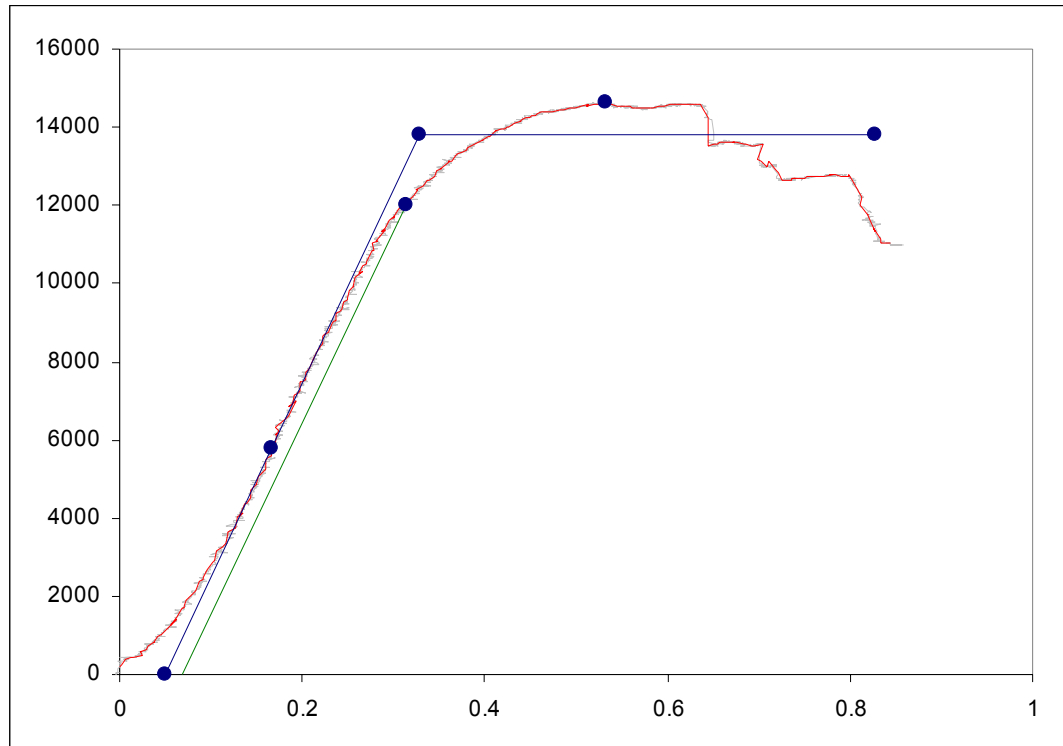


Figure A.28: Load (lbs) vs. Deflection (in.) plot. Test 462R5M03.

A.1.3 – 4X Series Monotonic

Table A.10: Connection and member properties, 4X1R1M Series.

Connection Properties 4X1R1M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	3019.07	3093.64	3042.39	3051.70	38.15	0.01
Displacement (in) =	1.45	1.58	1.56	1.53	0.07	0.04
Failure Load (lbs) =	2908.53	3092.63	3042.39	3014.52	95.16	0.03
Disp. @ Failure (in) =	1.52	1.59	1.56	1.55	0.04	0.02
40% Max (lbs) =	1207.10	1207.28	1190.81	1201.73	9.46	0.01
Displacement (in) =	0.21	0.19	0.23	0.21	0.02	0.07
Yield (lbs) =	2608.25	2621.88	2563.30	2597.81	30.66	0.01
Displacement (in) =	0.35	0.35	0.39	0.36	0.02	0.06
5% Offset Yield =	1621.81	1747.96	1609.41	1659.73	76.66	0.05
Displacement (in) =	0.27	0.28	0.30	0.29	0.01	0.05
Elastic Stiffness (lb/in) =	9905.53	8848.16	8494.31	9082.67	734.26	0.08
Slack (in) =	0.08	0.06	0.08	0.08	0.02	0.20
Energy (lb*in) =	3398.56	3624.87	3384.83	3469.42	134.80	0.04
Ductility Ratio =	4.37	4.48	4.02	4.29	0.24	0.06
Yield Mode =	IV	IV	IV			
Failure Mode =	N.A.	N.A.	N.A.			
Governing Member =	N.A.	N.A.	N.A.			
Member Properties 4X1R1M Series						
Member A						
M.C. (%) =	14.47	15.30	15.26	15.01	0.47	0.03
S.G. =	0.50	0.43	0.46	0.46	0.04	0.08
D.E. 5% Yield (psi) =	3809.89	3825.80	4111.33	3915.67	169.63	0.04
D.E. Capacity (psi) =	3885.95	4023.64	4181.44	4030.35	147.86	0.04
Member B						
M.C. (%) =	16.38	14.99	16.89	16.09	0.98	0.06
S.G. =	0.45	0.41	0.44	0.43	0.02	0.05
D.E. 5% Yield (psi) =	3456.96	3763.09	4271.75	3830.60	411.57	0.11
D.E. Capacity (psi) =	3831.19	3994.76	4688.01	4171.32	454.88	0.11

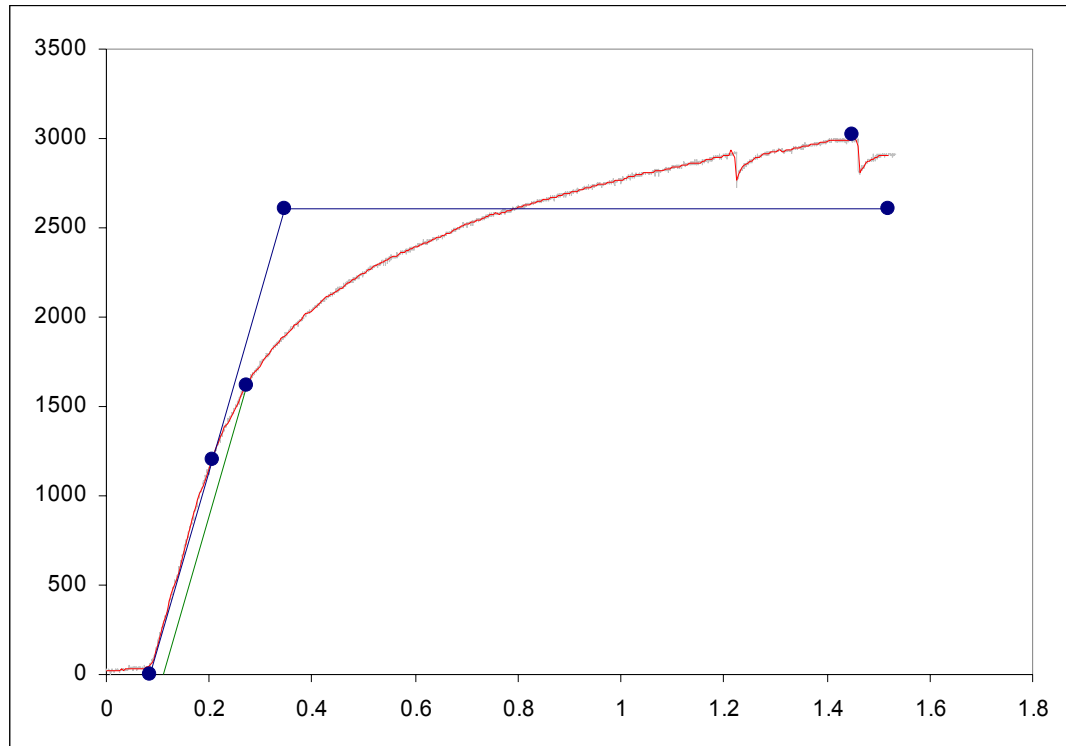


Figure A.29: Load (lbs) vs. Deflection (in.) plot. Test 4X1R1M01.

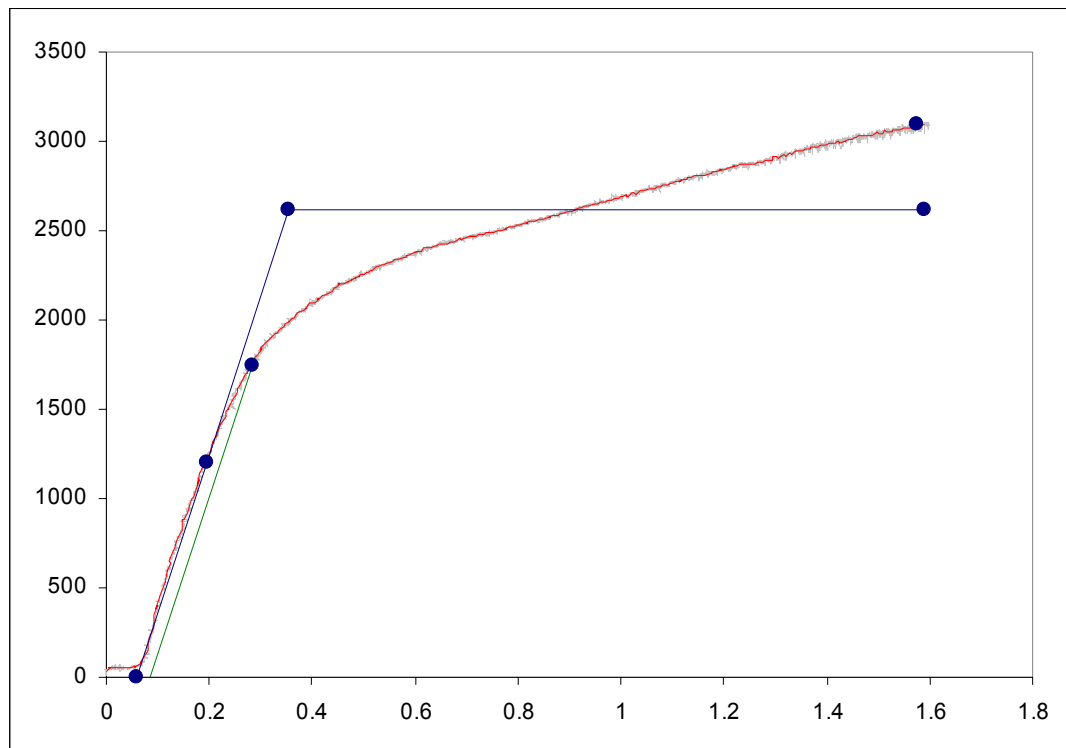


Figure A.30: Load (lbs) vs. Deflection (in.) plot. Test 4X1R1M02.

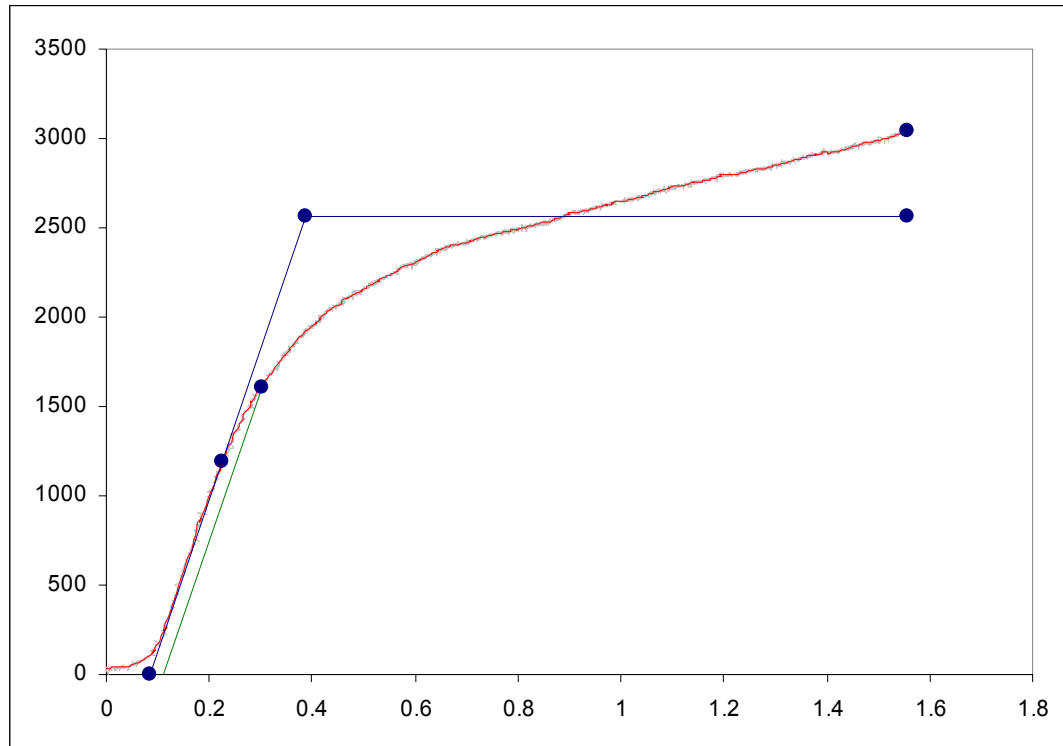


Figure A.31: Load (lbs) vs. Deflection (in.) plot. Test 4X1R1M03.

Table A.11: Connection and member properties, 4X1R5M Series.

Connection Properties 4X1R5M Series						
	Test 1	Test 2	Test 3	Mean	Standard Deviation	COV
Max Load (lbs) =	9094.61	7508.07	8037.68	8213.45	807.74	0.10
Displacement (in) =	0.55	0.48	0.51	0.51	0.03	0.06
Failure Load (lbs) =	6693.21	7097.38	7393.42	7061.34	351.49	0.05
Disp. @ Failure (in) =	0.81	0.58	0.81	0.73	0.14	0.19
40% Max (lbs) =	3591.90	2978.19	3102.62	3224.24	324.43	0.10
Displacement (in) =	0.21	0.17	0.15	0.18	0.03	0.19
Yield (lbs) =	8446.96	7089.25	7431.15	7655.79	706.18	0.09
Displacement (in) =	0.39	0.30	0.29	0.33	0.06	0.17
5% Offset Yield =	7424.16	6063.00	5281.93	6256.36	1084.12	0.17
Displacement (in) =	0.38	0.30	0.24	0.31	0.07	0.23
Elastic Stiffness (lb/in) =	26748.25	31141.67	30264.65	29384.86	2325.09	0.08
Slack (in) =	0.08	0.07	0.04	0.06	0.02	0.29
Energy (lb*in) =	4892.15	2744.44	4767.03	4134.54	1205.49	0.29
Ductility Ratio =	2.08	1.91	2.80	2.26	0.47	0.21
Yield Mode =	IV	IV	IV			
Failure Mode =	N.A.	Splitting	Splitting			
Governing Member =	N.A.	A	A			
Member Properties 4X1R5M Series						
Member A						
M.C. (%) =	15.59	11.39	16.81	14.60	2.84	0.19
S.G. =	0.38	0.43	0.42	0.41	0.03	0.06
D.E. 5% Yield (psi) =	3045.80	4764.72	4180.11	3996.88	873.99	0.22
D.E. Capacity (psi) =	3502.06	5036.13	4454.96	4331.05	774.51	0.18
Member B						
M.C. (%) =	10.73	16.49	16.61	14.61	3.36	0.23
S.G. =	0.41	0.45	0.40	0.42	0.03	0.06
D.E. 5% Yield (psi) =	5468.68	3875.14	3619.23	4321.02	1002.10	0.23
D.E. Capacity (psi) =	5468.68	4443.24	3795.60	4569.17	843.62	0.18

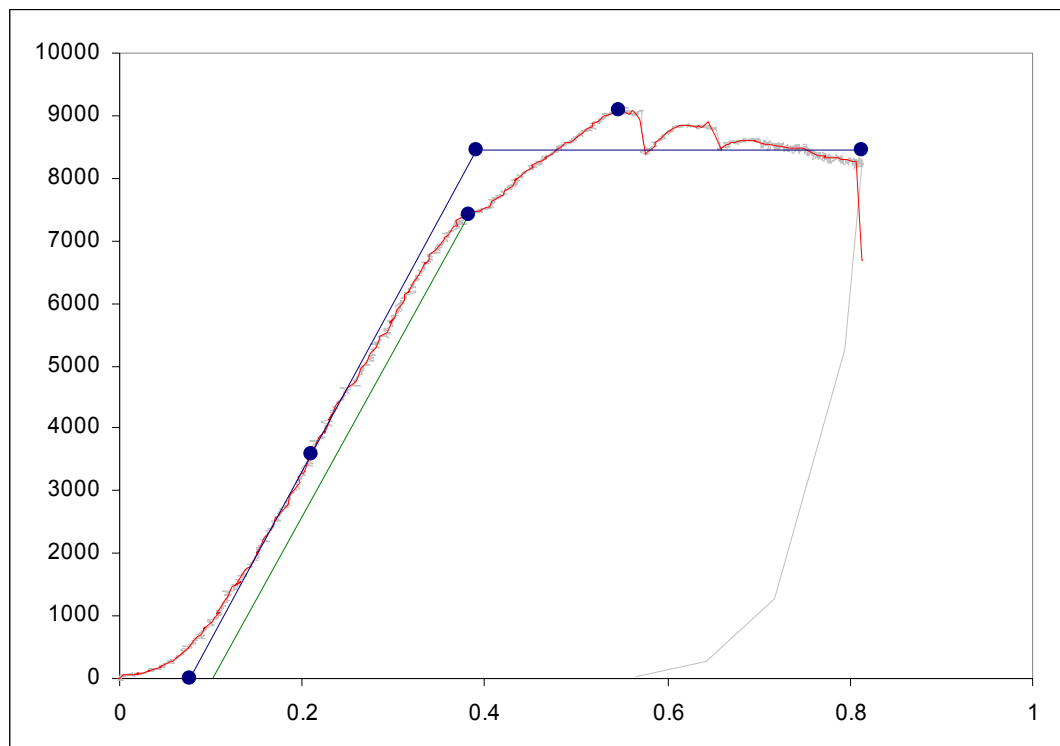


Figure A.32: Load (lbs) vs. Deflection (in.) plot. Test 4X1R5M01.

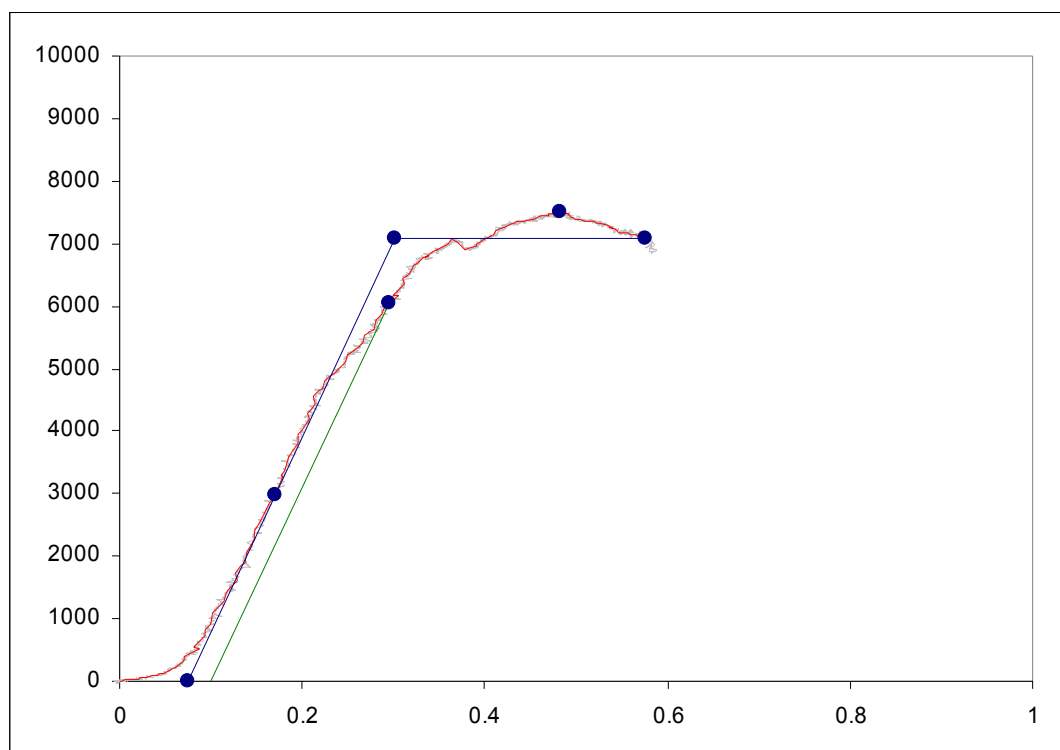


Figure A.33: Load (lbs) vs. Deflection (in.) plot. Test 4X1R5M02.

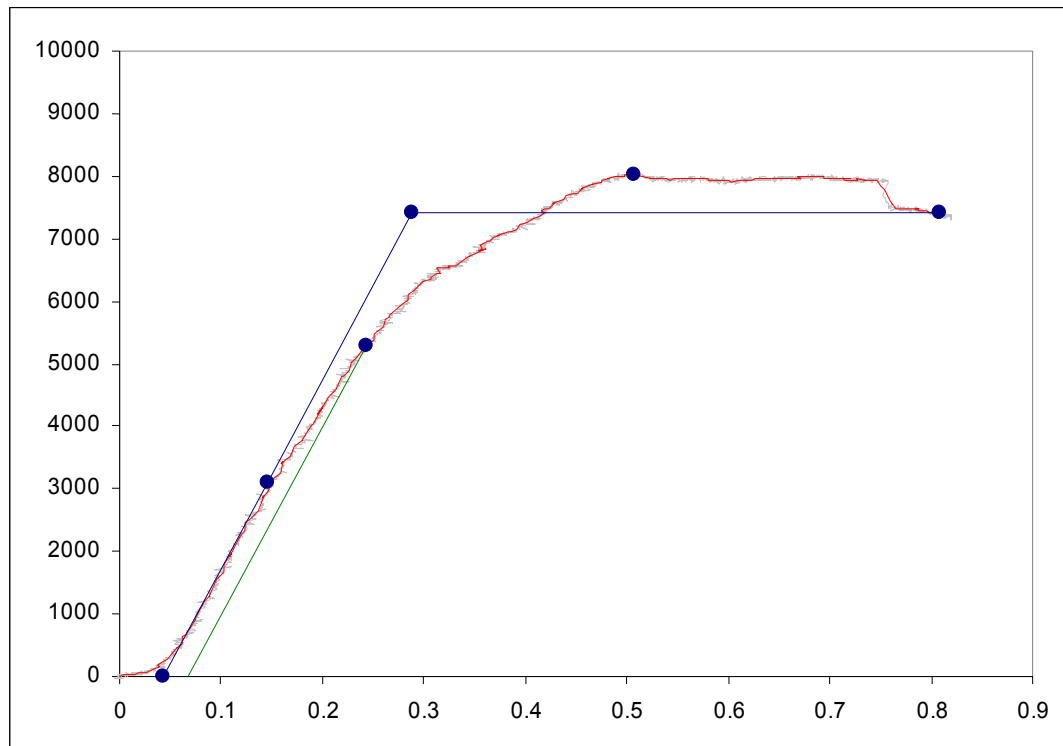


Figure A.34: Load (lbs) vs. Deflection (in.) plot. Test 4X1R5M03.