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(ROCK MECHANICS & EXCAVATION LABORATORIES)

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RESULTS OF ROCK PROPERTIES TESTS

Sampling Site: Koeberg

BY

DR J. F. CHEN

Submitted to:

SRK Consulting, South Africa

8 OCTOBER 2021

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TABLE 1 RESULTS OF UNIAXIAL COMPRESSION TESTS WITH ELASTIC MODULUS & POISSON RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Client: SRK Consulting SA

Sampling site: Koeberg

08-10-2021

SPECIMEN PARTICULARS				SPECIMEN DIMENSIONS					SPECIMEN TEST RESULTS										
Rocklab Specimen No	Borehole ID	Depth		Rock Type	Diameter	Height	Ratio of Height to diameter	Mass	Density	Failure Load	Strength (UCS)	Tangent Elastic Modulus @ 50% UCS	Secant Elastic Modulus @ 50% UCS	Poisson's Ratio Tangent @ 50% UCS	Poisson's Ratio Secant @ 50% UCS	Linear Axial Strain at Failure mm/mm	Failure Code	Note	
		From.. (m)	To.. (m)																
UCM-01	KB 46	45.60	45.90		82.85	145.5	1.8	1802.33	2.30	23.7	4.4	4.2	4.2	0.32	0.32	0.001051	0B		
UCM-02		54.06	54.33		16.94	38.7	2.3	20.68	2.37	2.2	9.9	8.0	8.0	0.20	0.20	0.001230	1B		
UCM-03		59.31	59.60																1
UCM-04		65.64	65.90		82.49	177.3	2.1	2436.40	2.57	58.8	11.0	1.8	2.0	0.18	0.17	0.005861	0B		
UCM-05		69.30	69.60		84.38	190.7	2.3	2745.13	2.57	74.5	13.3	18.6	21.6	0.24	0.28	0.000665	0B		
UCM-06		71.62	71.85		84.12	184.4	2.2	2655.44	2.59	143.7	25.9	18.7	24.7	0.21	0.16	0.001225	0B		
UCM-07		77.73	78.06		84.45	189.7	2.2	2767.10	2.60	149.2	26.6	28.9	32.3	0.34	0.35	0.000902	0B		
UCM-08	KB49	37.48	37.75		81.12	143.0	1.8	1690.89	2.29	63.7	12.3	2.7	2.7	0.19	0.19	0.004539	0B		
UCM-09		39.04	39.42		78.23	154.3	2.0	1691.35	2.28	80.0	16.6	1.5	2.2	0.33	0.31	0.013815	XA		
UCM-10		60.70	61.07		83.18	133.0	1.6	1878.20	2.60	128.6	23.7	19.2	19.2	0.21	0.21	0.001233	0B		
UCM-11		65.05	65.28		83.38	203.4	2.4	2870.10	2.58	106.4	19.5	20.1	26.2	0.26	0.25	0.000977	0B		
UCM-12		70.43	70.67		83.54	193.6	2.3	2792.73	2.63	329.0	60.0	29.9	33.1	0.15	0.12	0.001945	4B		
UCM-13		72.10	72.44		83.28	192.4	2.3	2775.87	2.65	99.7	18.3	7.0	8.0	0.14	0.16	0.002450	0B		
UCM-14		78.49	78.68		83.46	186.0	2.2	2657.67	2.61	176.2	32.2	20.0	21.3	0.15	0.11	0.001665	4B		
UCM-15	KB50B	40.51	40.78		80.65	107.7	1.3	1158.65	2.11	28.7	5.6	1.1	1.1	0.36	0.15	0.006474	XA		
UCM-16		42.31	42.64		81.04	123.7	1.5	1393.72	2.18	38.5	7.5	1.1	1.1	0.21	0.16	0.008182	XA		
UCM-17		43.69	44.02		81.46	158.9	2.0	1869.14	2.26	23.6	4.5	2.0	2.4	0.10	0.06	0.001950	3B		
UCM-18		53.60	53.97		81.93	199.0	2.4	2458.44	2.34	121.0	23.0	5.1	7.3	0.11	0.16	0.004542	5B		
UCM-19		54.25	54.57		83.16	179.3	2.2	2324.71	2.39	54.2	10.0	3.4	4.2	0.16	0.18	0.002461	0B		
UCM-20	KB51	55.11	55.40		83.53	200.1	2.4	2589.58	2.36	100.8	18.4	7.1	9.3	0.09	0.11	0.002367	3B		
UCM-21		58.86	59.28		83.30	194.8	2.3	2700.91	2.54	255.4	46.9	14.7	16.2	0.24	0.14	0.003037	0B		
UCM-22		33.45	33.71		84.86	191.0	2.3	2711.36	2.51	181.9	32.2	18.1	21.1	0.16	0.15	0.001625	3B		
UCM-23		41.34	41.57		84.62	101.1	1.2	1372.58	2.41	122.2	21.7	9.9	9.1	0.25	0.23	0.002800	XA		
UCM-24		46.33	46.71		48.82	114.7	2.3	522.70	2.43	45.8	24.5	7.6	9.4	0.19	0.10	0.003071	4B		
UCM-25		48.12	48.31		84.57	186.3	2.2	2562.55	2.45	191.5	34.1	6.1	7.6	0.18	0.10	0.005640	1B		
UCM-26		58.48	58.79		84.52	208.0	2.5	2679.98	2.30	48.6	8.7	5.7	5.4	0.17	0.15	0.001749	0B		
UCM-27		71.35	71.62		84.54	182.9	2.2	2689.96	2.62	83.8	14.9	11.5	12.5	0.49	0.26	0.001474	0B		
UCM-28	KB53	40.88	41.25		78.42	203.6	2.6	1973.47	2.01	30.9	6.4	2.1	2.5	0.17	0.10	0.003291	3B		
UCM-29		53.62	53.94		80.22	172.3	2.1	2070.44	2.38	103.3	20.4	5.7	7.8	0.25	0.11	0.003646	XA		
UCM-30		61.90	62.17		85.49	198.1	2.3	2562.35	2.25	63.8	11.1	3.5	4.6	0.19	0.25	0.002806	0B		
UCM-31		66.22	66.42		84.01	187.6	2.2	2576.33	2.48	149.2	26.9	27.6	31.4	0.24	0.25	0.000915	0B		
UCM-32		70.92	71.19		84.09	187.8	2.2	2875.25	2.76	257.4	46.3	18.3	24.7	0.16	0.12	0.002347	2B		
UCM-33		72.93	73.20		84.27	197.8	2.3	2978.68	2.70	373.8	67.0	46.1	51.5	0.17	0.17	0.001402	0B		
UCM-34		31.69	31.97		81.90	199.7	2.4	2385.19	2.27	83.8	15.9	1.9	2.1	0.13	0.13	0.008151	XA		
UCM-35	32.93	33.15		81.10	142.7	1.8	1699.02	2.30	65.4	12.7	1.5	1.7	0.16	0.09	0.008209	0B			
UCM-36	37.61	37.95		84.14	198.0	2.4	2709.60	2.46	59.7	10.7	7.0	8.6	0.11	0.12	0.001315	0B			
UCM-37	40.40	40.73		83.43	201.0	2.4	2757.55	2.51	79.0	14.4	21.9	23.0	0.17	0.18	0.000661	0B			

UCM-38	KB47	46.20	46.40		84.26	197.0	2.3	2849.56	2.59	60.3	10.8	44.4	46.3	0.21	0.24	0.000246	3B	
UCM-39		53.80	54.04		84.42	202.6	2.4	2967.75	2.62	175.6	31.4	27.7	19.9	0.18	0.13	0.001419	0B	
UCM-40		58.96	59.16		84.38	210.8	2.5	3087.38	2.62	228.4	40.8	32.6	37.0	0.19	0.17	0.001405	0B	
UCM-41		63.70	63.92		84.01	104.5	1.2	1549.39	2.68	149.7	27.0	47.4	55.9	0.23	0.25	0.000532	0B	
UCM-42		79.20	79.22		84.35	130.5	1.5	1985.08	2.72	224.2	40.1	66.1	67.8	0.29	0.28	0.000599	0B	
UCM-43	KB48	31.14	31.49															1
UCM-44		38.90	39.14		83.79	195.1	2.3	2732.93	2.54	151.4	27.5	14.9	19.4	0.19	0.26	0.001915	0B	
UCM-45		41.86	42.18		31.21	62.7	2.0	140.26	2.92	28.0	36.6	23.0	32.0	0.18	0.21	0.001400	0B	
UCM-46		44.25	44.66		84.19	216.7	2.6	3213.85	2.66	343.8	61.8	62.2	67.6	0.19	0.18	0.000973	0B	
UCM-47		45.47	45.78		84.65	210.3	2.5	3081.39	2.60	177.9	31.6	37.2	27.3	0.18	0.16	0.001017	0B	
UCM-48		56.63	57.00		84.30	205.6	2.4	3064.72	2.67	206.8	37.1	25.9	27.4	0.15	0.15	0.001460	4B	
UCM-49		73.09	73.40		84.22	203.7	2.4	3091.45	2.72	522.5	93.8	66.3	70.0	0.25	0.24	0.001386	0B	
UCM-50	KB52	25.13	25.51		84.20	209.6	2.5	2986.32	2.56	107.3	19.3	32.6	32.1	0.18	0.17	0.000643	0B	
UCM-51		27.55	27.74		84.37	190.3	2.3	2693.72	2.53	93.1	16.7	14.7	19.2	0.17	0.19	0.000942	0B	
UCM-52		32.44	32.78		84.47	168.8	2.0	2381.57	2.52	150.2	26.8	18.5	23.2	0.13	0.12	0.001439	0B	
UCM-53		40.09	40.44		84.80	200.6	2.4	2978.93	2.63	281.1	49.8	39.4	41.7	0.19	0.19	0.001257	0B	
UCM-54		50.82	50.98		84.79	119.0	1.4	1778.06	2.65	146.8	26.0	11.6	10.8	0.18	0.14	0.002334	0B	
UCM-55		55.27	55.44		84.87	95.9	1.1	1441.14	2.66	357.4	63.2	31.1	37.8	0.13	0.18	0.001879	0B	
UCM-56		57.59	57.77		84.88	193.6	2.3	2893.91	2.64	249.0	44.0	9.9	12.1	0.14	0.14	0.004036	0B	
UCM-57		64.83	65.10		84.87	185.5	2.2	2856.80	2.72	516.7	91.3	52.4	56.3	0.15	0.16	0.001768	0B	
UCM-58		68.30	68.52		84.89	210.4	2.5	3234.94	2.72	133.3	23.6	46.0	53.2	0.37	0.34	0.000493	0B	

Note: All tests were conducted according to the ISRM's Specification.

Failure codes shown in Appendix 2

1 - No suitable specimen could be prepared for the test.

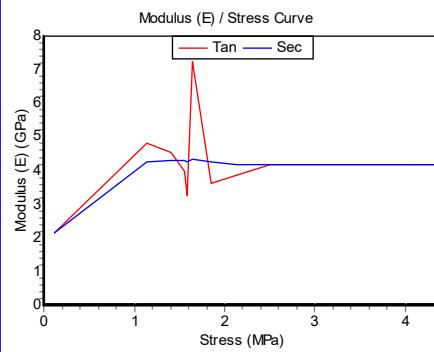
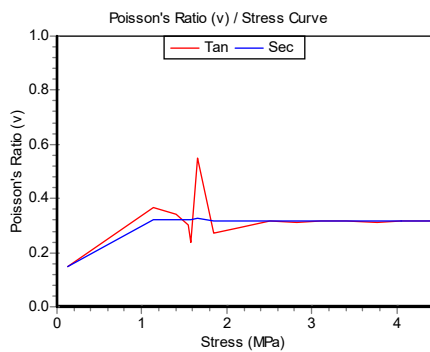
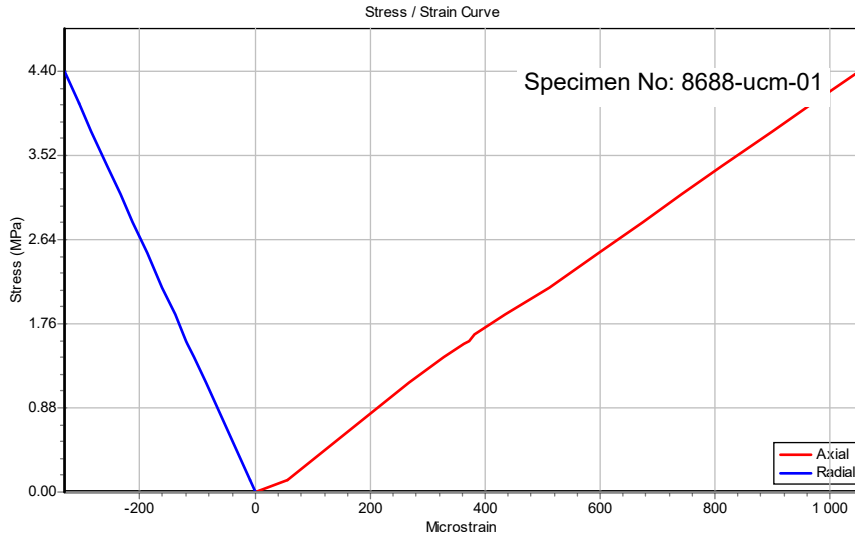
APPENDIX 1

STRESS VIA STRAIN CURVES FOR UCM TESTS

UNIAXIAL COMPRESSION TEST

2021/09/29 10:22:43

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 23.7 kN

Peak Strength: 4.4 MPa

Axial Strain at Failure: 1051 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.44	4.81	4.25	0.366	0.320
20	0.88	4.81	4.25	0.366	0.320
30	1.32	4.55	4.31	0.342	0.324
40	1.76	3.64	4.24	0.273	0.319
50	2.2	4.19	4.19	0.315	0.315
60	2.64	4.19	4.19	0.314	0.315
70	3.08	4.19	4.19	0.316	0.315
80	3.52	4.19	4.19	0.314	0.315
90	3.96	4.19	4.19	0.316	0.315

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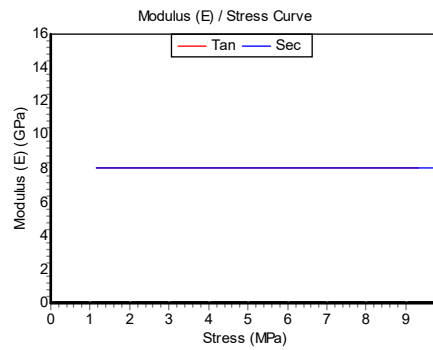
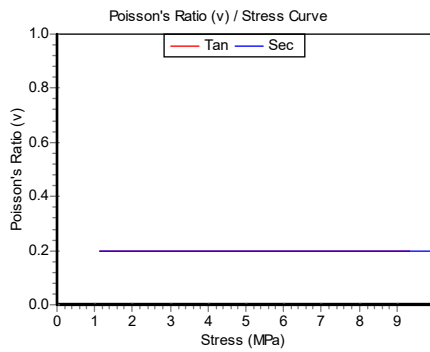
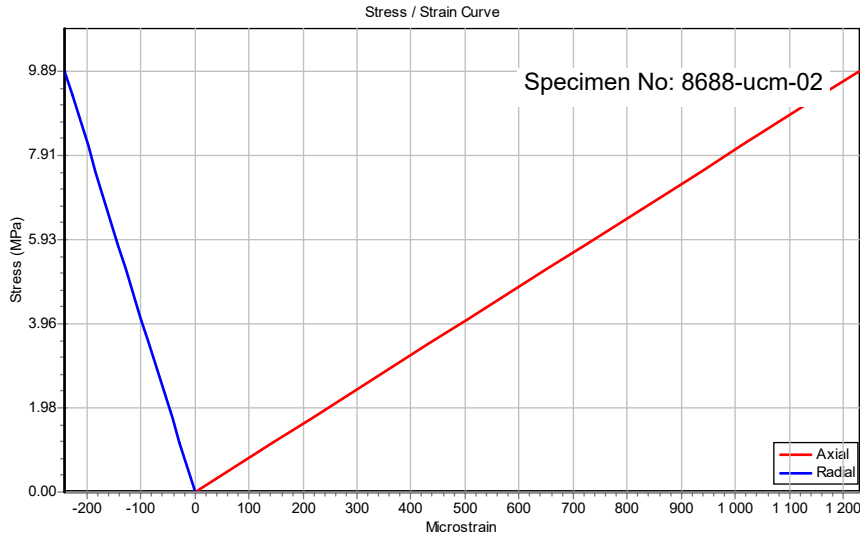
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UNIAXIAL COMPRESSION TEST

2021/09/29 14:33:58

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 2.23 kN

Peak Strength: 9.89 MPa

Axial Strain at Failure: 1230 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.989	8.04	8.04	0.197	0.197
20	1.98	8.04	8.04	0.196	0.196
30	2.97	8.04	8.04	0.196	0.196
40	3.96	8.04	8.04	0.197	0.197
50	4.95	8.04	8.04	0.196	0.196
60	5.93	8.04	8.04	0.196	0.196
70	6.92	8.04	8.04	0.196	0.196
80	7.91	8.04	8.04	0.197	0.196
90	8.9	8.04	8.04	0.196	0.196

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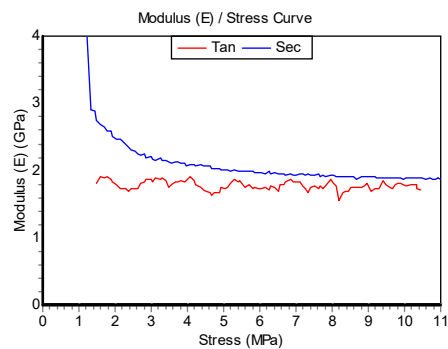
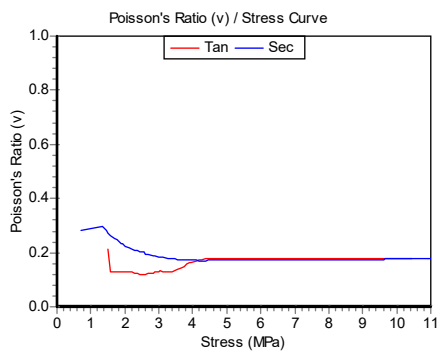
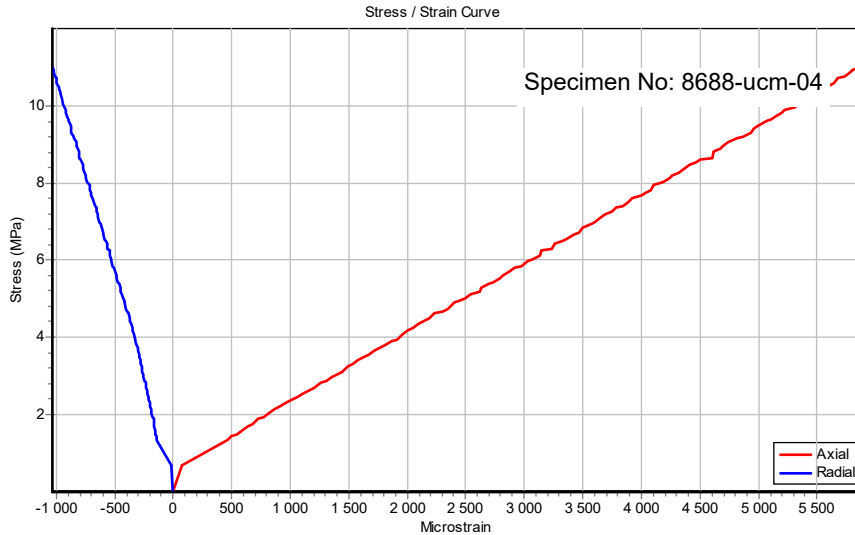
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:55:57

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 58.81 kN

Peak Strength: 11 MPa

Axial Strain at Failure: 5861 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.1	0	2.92	0.000	0.296
20	2.2	1.73	2.42	0.130	0.214
30	3.3	1.88	2.16	0.131	0.179
40	4.4	1.71	2.07	0.178	0.171
50	5.5	1.78	1.99	0.179	0.173
60	6.6	1.79	1.95	0.179	0.174
70	7.7	1.73	1.92	0.179	0.175
80	8.8	1.74	1.91	0.179	0.175
90	9.9	1.8	1.89	0.179	0.176

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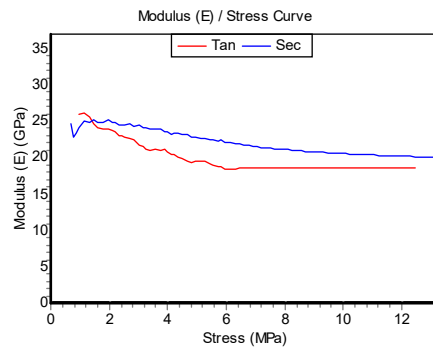
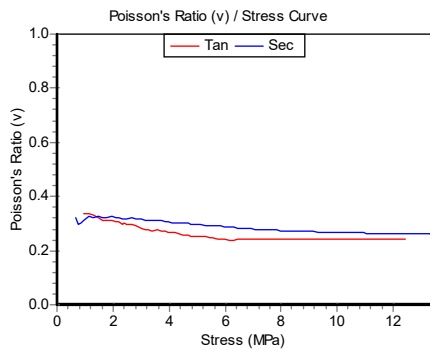
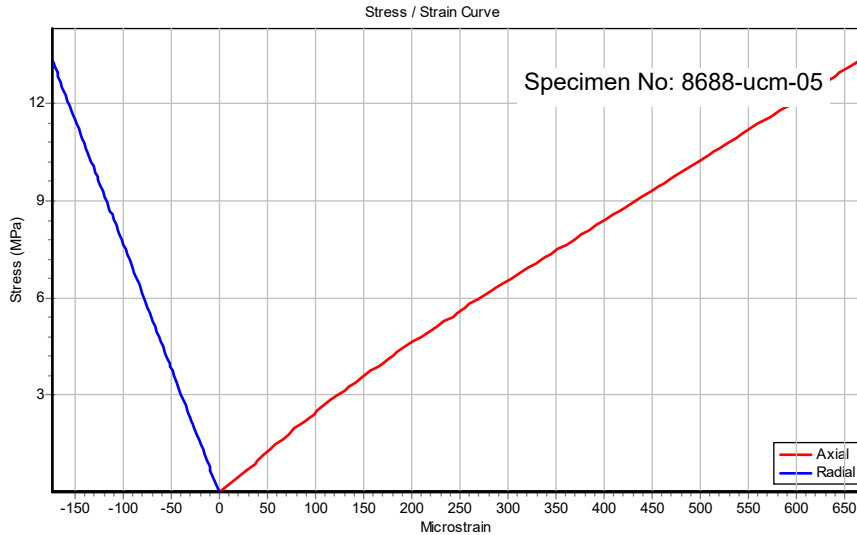
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:52:37

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 74.53 kN

Peak Strength: 13.33 MPa

Axial Strain at Failure: 665 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.33	24.8	25.3	0.322	0.328
20	2.67	22.7	24.7	0.295	0.322
30	4	20.5	23.3	0.266	0.302
40	5.33	19.2	22.4	0.250	0.291
50	6.67	18.6	21.6	0.241	0.281
60	8	18.6	21.1	0.243	0.274
70	9.33	18.6	20.7	0.241	0.269
80	10.7	18.6	20.4	0.241	0.265
90	12	18.6	20.2	0.241	0.262

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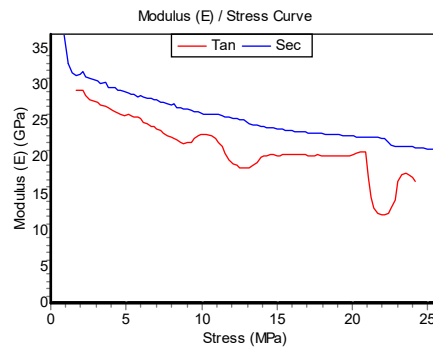
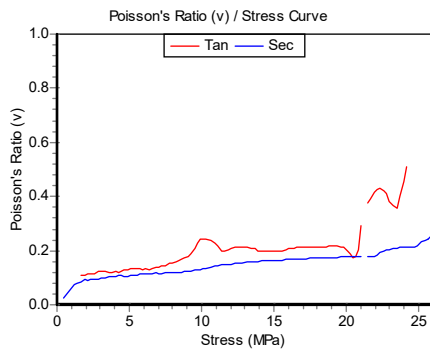
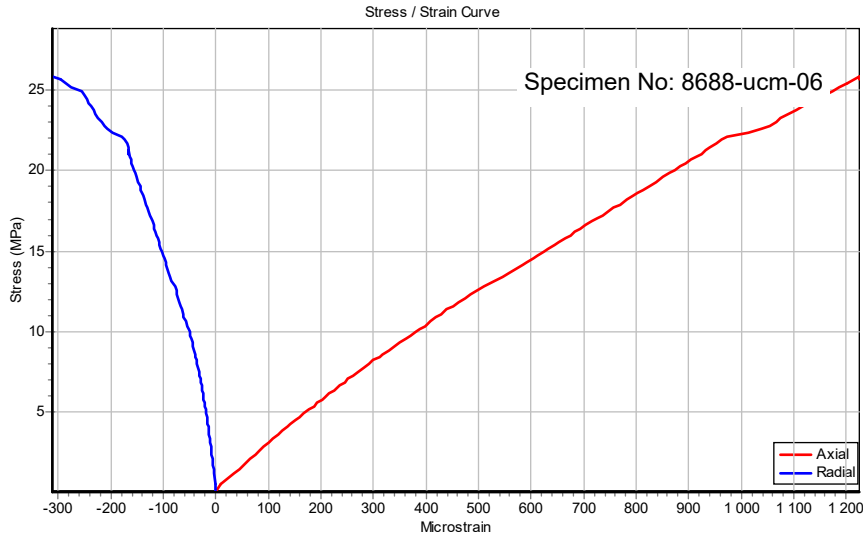
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:13:59

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 143.7 kN

Peak Strength: 25.85 MPa

Axial Strain at Failure: 1225 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.59	28	30.9	0.116	0.092
20	5.17	25.9	28.7	0.134	0.111
30	7.76	22.9	27.3	0.153	0.120
40	10.3	23.1	25.9	0.237	0.138
50	12.9	18.7	24.7	0.214	0.158
60	15.5	20.4	23.8	0.199	0.165
70	18.1	20.3	23.3	0.214	0.172
80	20.7	20.9	22.9	0.179	0.178
90	23.3	17.9	21.6	0.355	0.209

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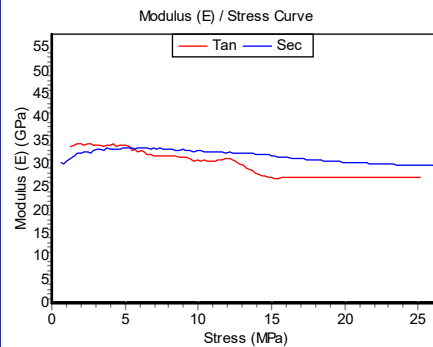
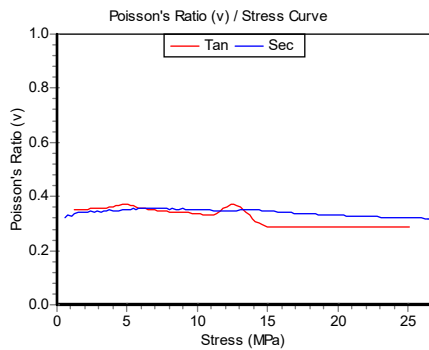
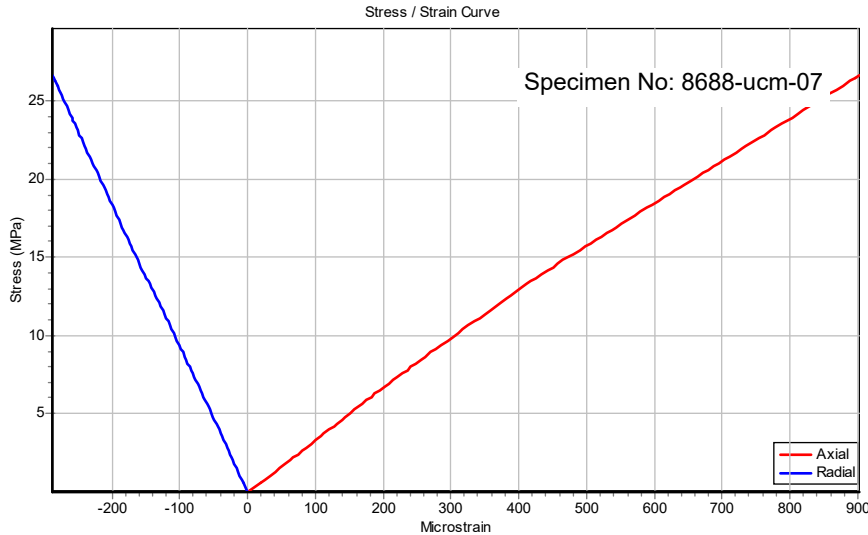
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:19:11

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 149.2 kN

Peak Strength: 26.63 MPa

Axial Strain at Failure: 902 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.66	34.1	33	0.354	0.346
20	5.33	32.9	33.6	0.364	0.354
30	7.99	31.7	33.2	0.344	0.353
40	10.7	30.6	32.7	0.331	0.351
50	13.3	28.9	32.3	0.344	0.351
60	16	27.1	31.4	0.288	0.342
70	18.6	27.1	30.7	0.288	0.333
80	21.3	27.1	30.2	0.287	0.327
90	24	27.1	29.8	0.287	0.322

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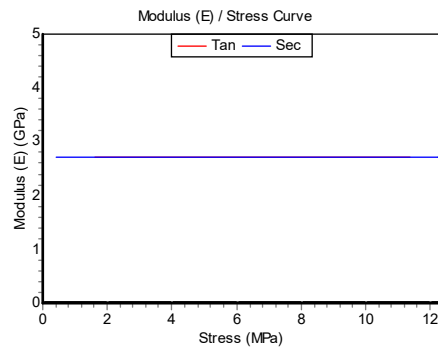
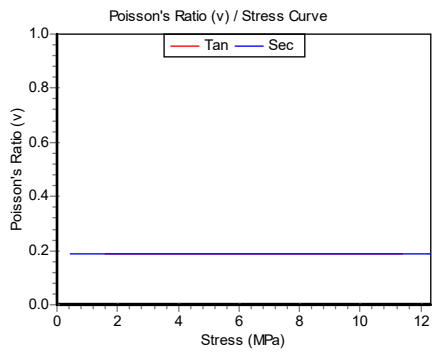
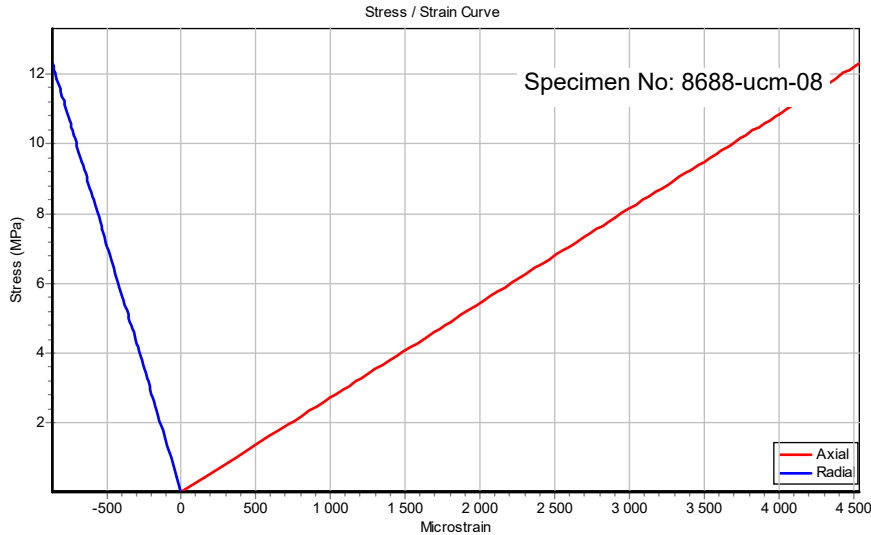
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:30:15

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 63.65 kN

Peak Strength: 12.32 MPa

Axial Strain at Failure: 4539 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.23	0	2.71	0.000	0.190
20	2.46	2.71	2.71	0.190	0.190
30	3.7	2.71	2.71	0.190	0.190
40	4.93	2.71	2.71	0.190	0.190
50	6.16	2.71	2.71	0.190	0.190
60	7.39	2.71	2.71	0.190	0.190
70	8.62	2.71	2.71	0.190	0.190
80	9.86	2.71	2.71	0.190	0.190
90	11.1	2.71	2.71	0.190	0.190

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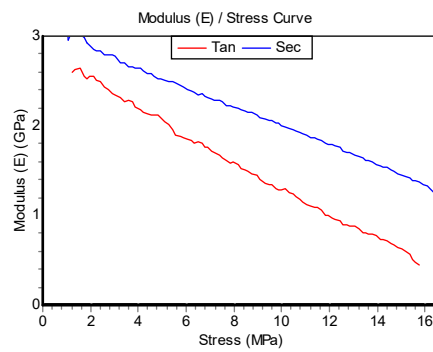
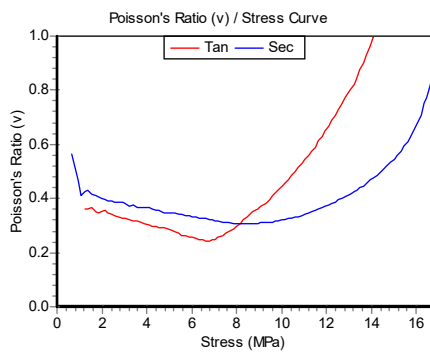
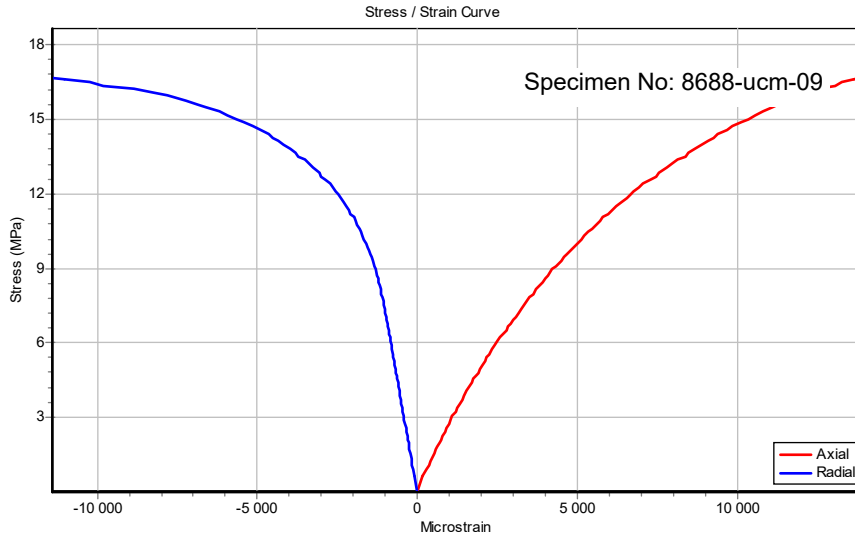
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:33:21

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 80.02 kN

Peak Strength: 16.65 MPa

Axial Strain at Failure: 13815 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.66	2.55	2.98	0.353	0.412
20	3.33	2.28	2.71	0.315	0.374
30	4.99	2.04	2.51	0.283	0.347
40	6.66	1.76	2.33	0.244	0.323
50	8.32	1.5	2.16	0.330	0.308
60	9.99	1.28	1.99	0.444	0.321
70	11.7	1.06	1.83	0.612	0.359
80	13.3	0.811	1.64	0.848	0.432
90	15	0.627	1.45	1.289	0.547

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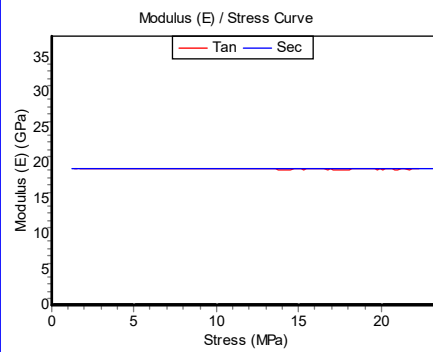
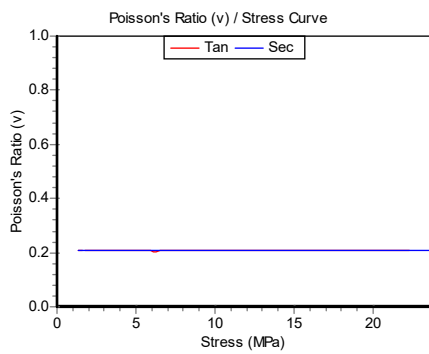
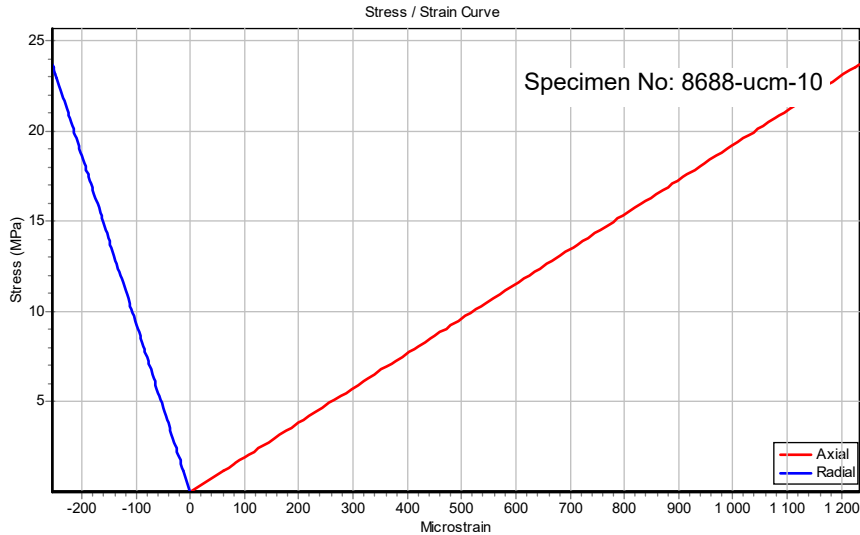
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:42:27

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 128.6 kN

Peak Strength: 23.67 MPa

Axial Strain at Failure: 1233 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.37	19.2	19.2	0.206	0.206
20	4.73	19.2	19.2	0.206	0.206
30	7.1	19.2	19.2	0.206	0.206
40	9.47	19.2	19.2	0.206	0.206
50	11.8	19.2	19.2	0.206	0.206
60	14.2	19.2	19.2	0.207	0.206
70	16.6	19.2	19.2	0.207	0.206
80	18.9	19.2	19.2	0.207	0.206
90	21.3	19.2	19.2	0.206	0.206

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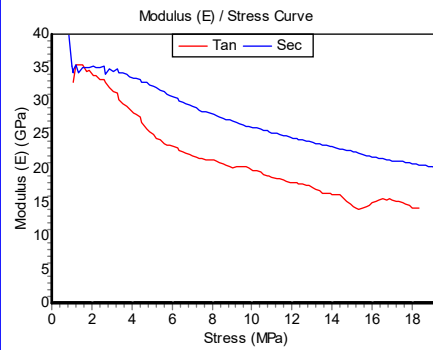
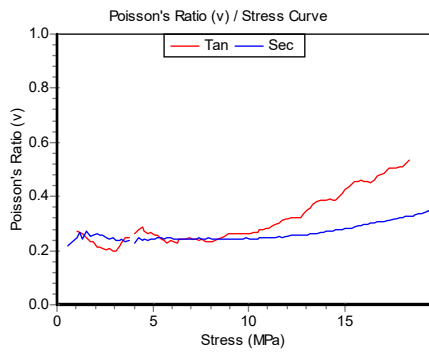
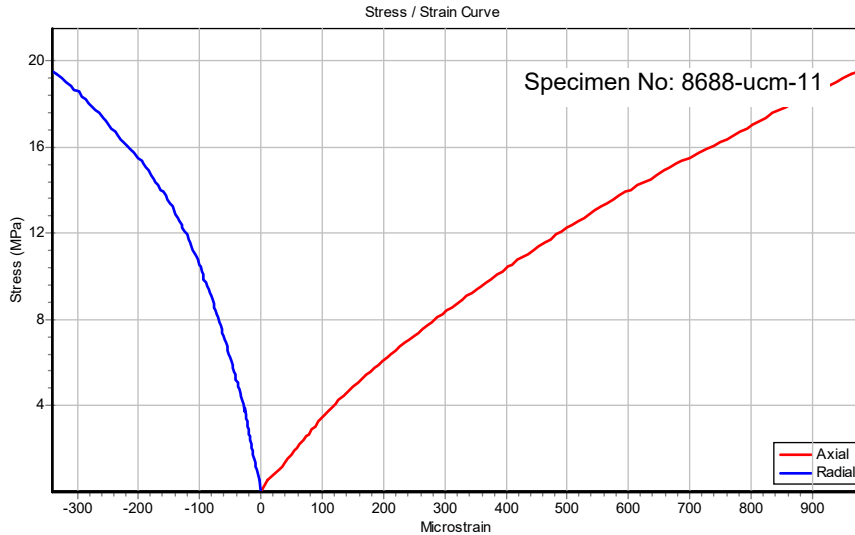
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:44:43

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 106.4 kN

Peak Strength: 19.48 MPa

Axial Strain at Failure: 977 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.95	33.8	35.2	0.214	0.263
20	3.9	28.4	33.4	0.263	0.227
30	5.84	23.5	30.8	0.237	0.246
40	7.79	21.4	28.2	0.231	0.246
50	9.74	20.1	26.2	0.263	0.248
60	11.7	18	24.8	0.311	0.250
70	13.6	16.3	23.4	0.387	0.265
80	15.6	14.3	21.9	0.454	0.291
90	17.5	15	21	0.503	0.317

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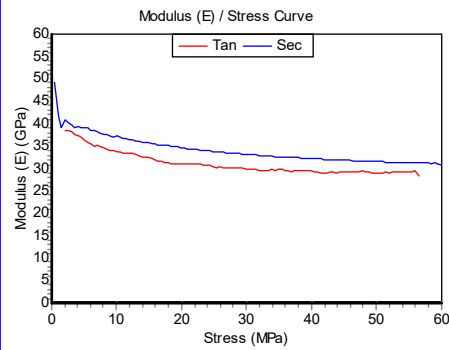
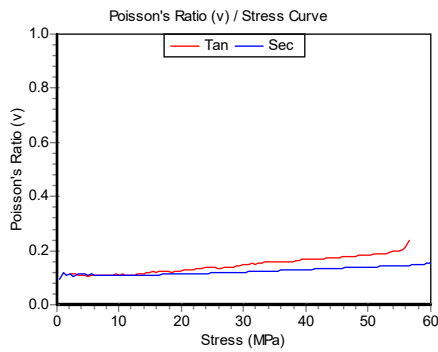
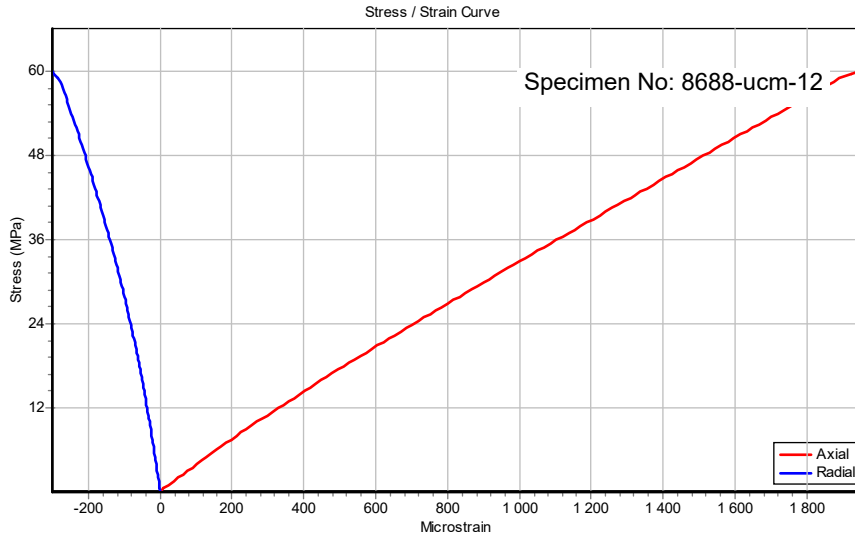
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:27:30

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 329 kN

Peak Strength: 60.02 MPa

Axial Strain at Failure: 1945 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	6	35.5	38.6	0.107	0.111
20	12	33.3	36.4	0.111	0.111
30	18	31.1	35	0.121	0.113
40	24	30.6	33.9	0.137	0.116
50	30	29.9	33.1	0.148	0.121
60	36	29.5	32.5	0.159	0.127
70	42	29.1	32.1	0.170	0.133
80	48	29.3	31.6	0.181	0.138
90	54	29.3	31.4	0.199	0.144

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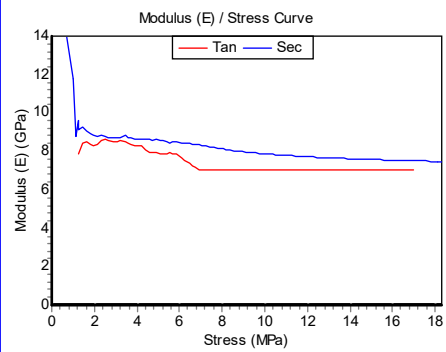
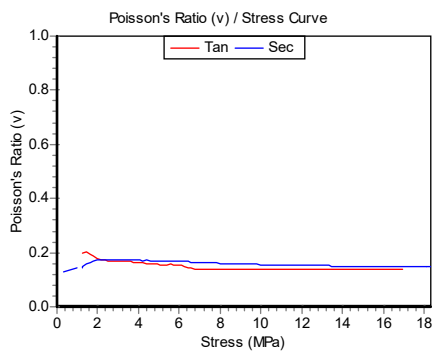
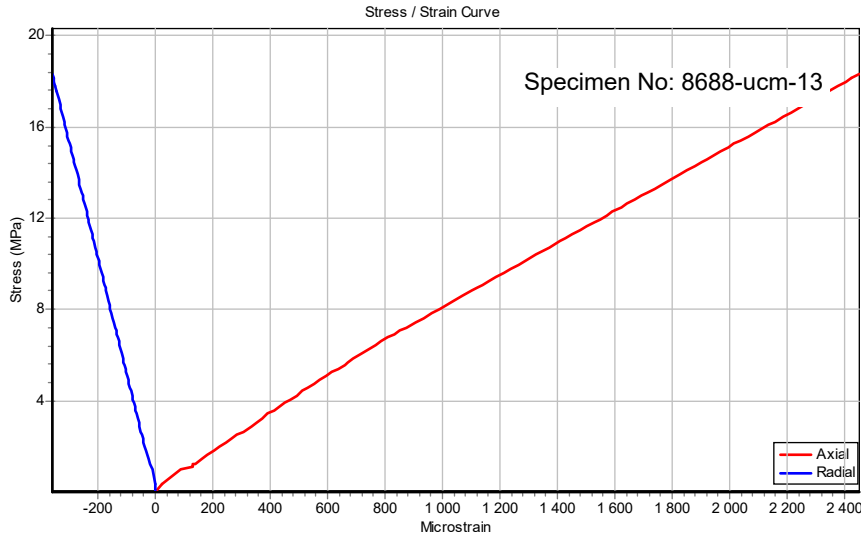
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:57:31

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 99.68 kN

Peak Strength: 18.3 MPa

Axial Strain at Failure: 2450 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.83	8.32	8.83	0.180	0.174
20	3.66	8.33	8.68	0.164	0.171
30	5.49	7.93	8.46	0.156	0.167
40	7.32	7.03	8.22	0.139	0.162
50	9.15	7.03	7.96	0.138	0.157
60	11	7.03	7.78	0.139	0.153
70	12.8	7.03	7.67	0.138	0.151
80	14.6	7.03	7.58	0.138	0.149
90	16.5	7.03	7.52	0.139	0.148

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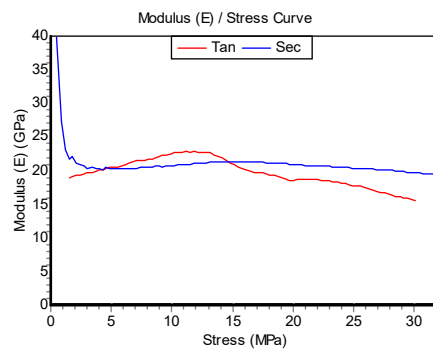
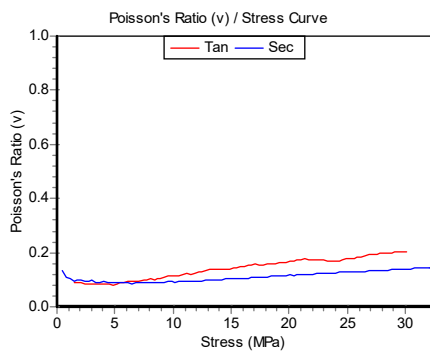
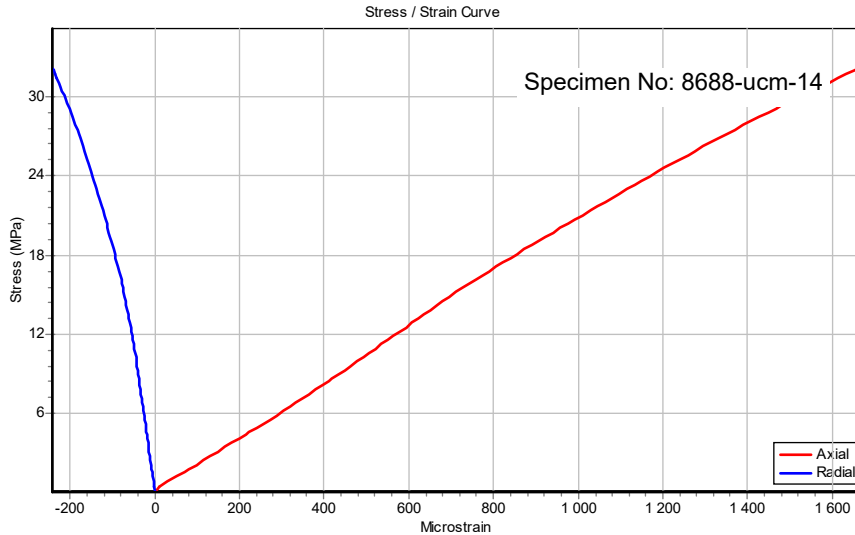
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UNIAXIAL COMPRESSION TEST

2021/10/05 09:32:18

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 176.2 kN

Peak Strength: 32.2 MPa

Axial Strain at Failure: 1665 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.22	19.8	20.5	0.083	0.090
20	6.44	21	20.3	0.093	0.086
30	9.66	22.5	20.8	0.113	0.092
40	12.9	22.7	21.2	0.138	0.099
50	16.1	20	21.3	0.149	0.105
60	19.3	18.7	21	0.163	0.114
70	22.5	18.5	20.6	0.173	0.123
80	25.8	17.5	20.3	0.182	0.130
90	29	15.9	19.8	0.202	0.138

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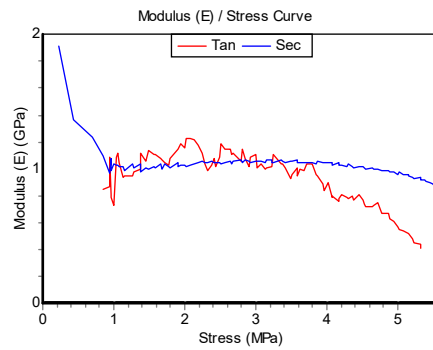
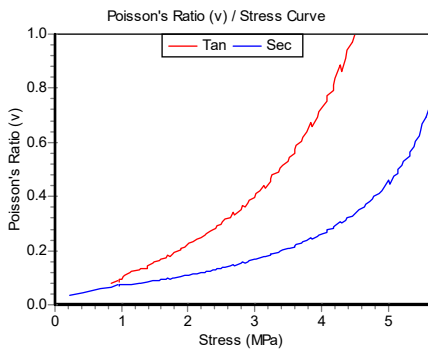
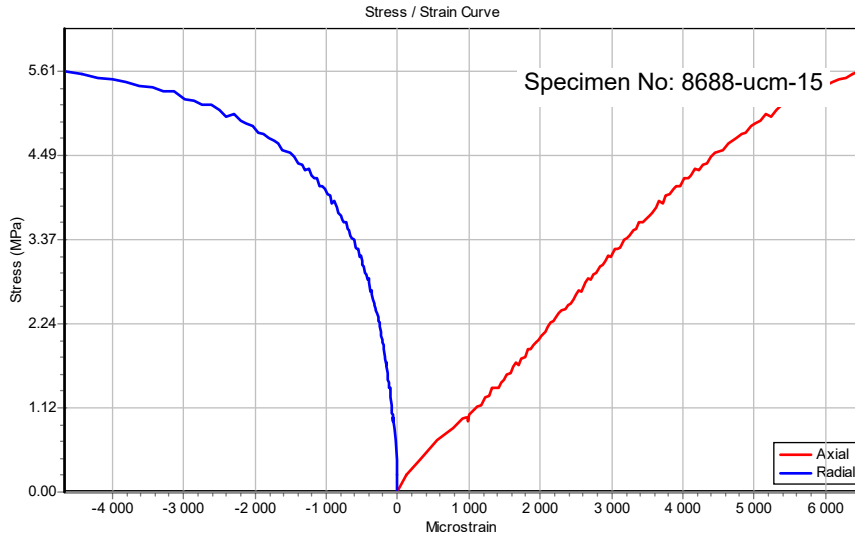
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UNIAXIAL COMPRESSION TEST

2021/09/29 10:58:17

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 28.68 kN

Peak Strength: 5.61 MPa

Axial Strain at Failure: 6474 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.561	0	1.23	0.000	0.058
20	1.12	0.933	1.02	0.118	0.074
30	1.68	1.04	1.04	0.179	0.095
40	2.24	1.11	1.05	0.255	0.120
50	2.81	1.08	1.07	0.360	0.154
60	3.37	1.03	1.05	0.503	0.198
70	3.93	0.89	1.05	0.693	0.252
80	4.49	0.767	1.01	0.999	0.336
90	5.05	0.54	0.957	1.504	0.473

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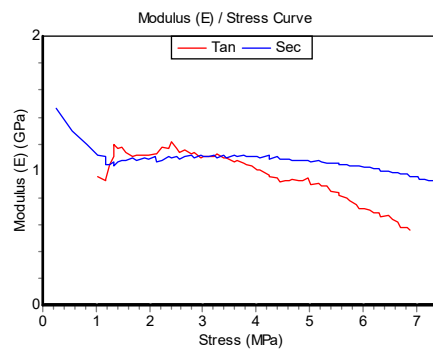
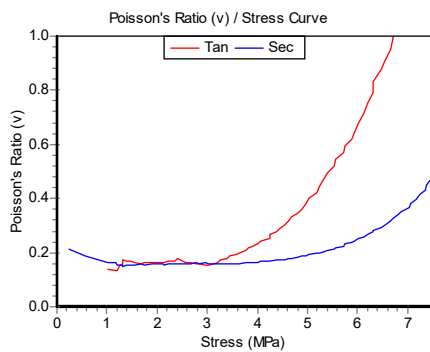
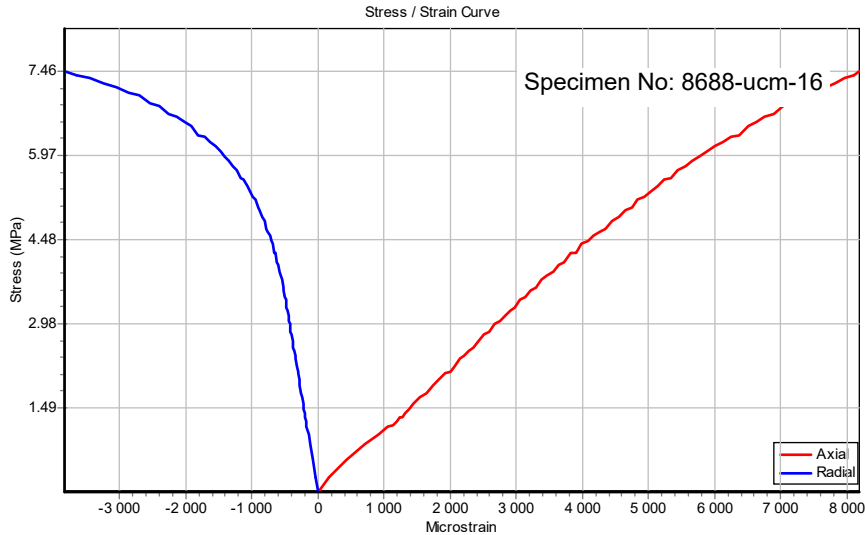
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:01:11

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 38.5 kN

Peak Strength: 7.46 MPa

Axial Strain at Failure: 8182 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.746	0	1.2	0.000	0.174
20	1.49	1.14	1.07	0.165	0.155
30	2.24	1.17	1.1	0.169	0.160
40	2.98	1.1	1.1	0.154	0.159
50	3.73	1.05	1.11	0.208	0.161
60	4.48	0.927	1.09	0.301	0.175
70	5.22	0.884	1.06	0.445	0.200
80	5.97	0.713	1.02	0.676	0.251
90	6.71	0.574	0.971	1.044	0.340

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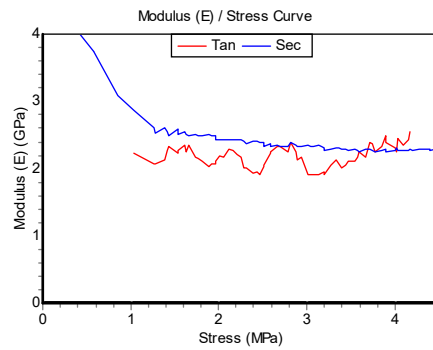
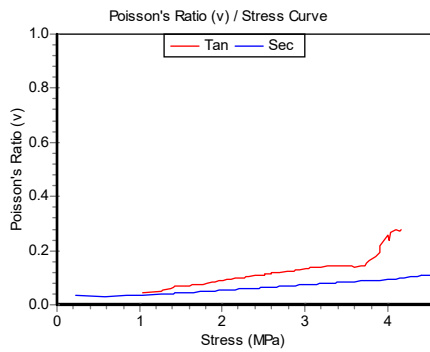
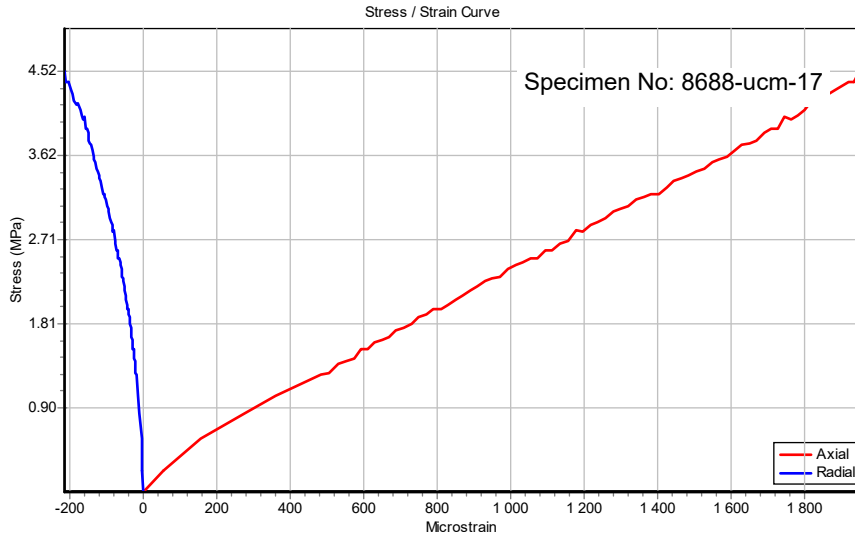
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:28:27

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 23.57 kN

Peak Strength: 4.52 MPa

Axial Strain at Failure: 1950 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.452	0	3.74	0.000	0.032
20	0.904	2.23	2.86	0.045	0.037
30	1.36	2.13	2.6	0.058	0.041
40	1.81	2.11	2.48	0.079	0.049
50	2.26	2.02	2.41	0.103	0.058
60	2.71	2.38	2.39	0.124	0.068
70	3.16	1.92	2.33	0.140	0.077
80	3.62	2.17	2.28	0.142	0.087
90	4.07	2.35	2.28	0.276	0.096

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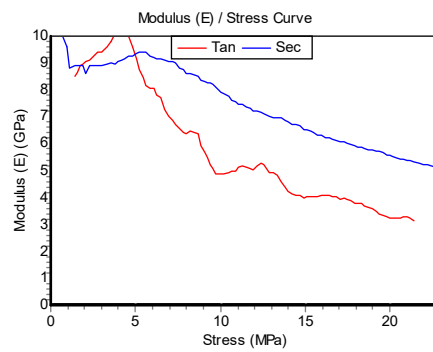
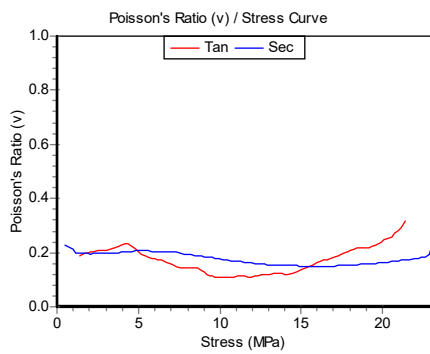
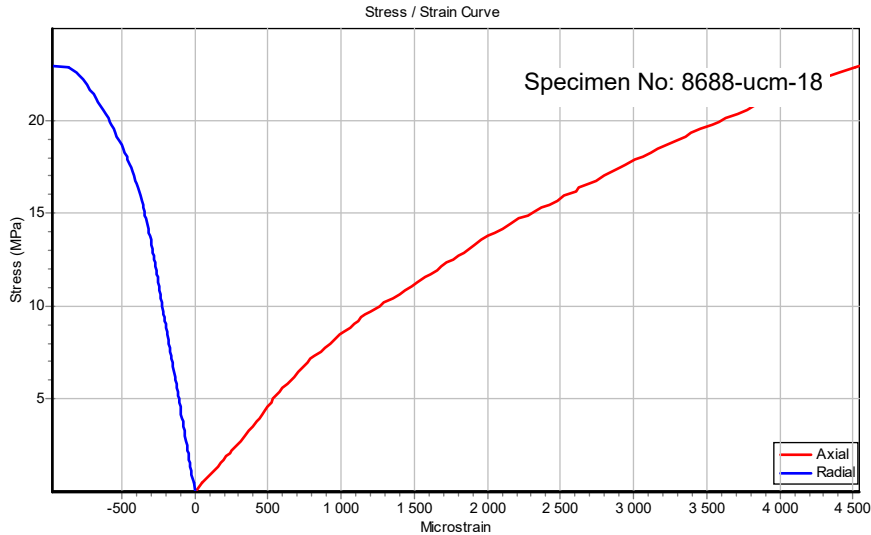
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:26:55

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 121 kN

Peak Strength: 22.96 MPa

Axial Strain at Failure: 4542 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.3	9.27	8.88	0.206	0.198
20	4.59	9.58	9.27	0.213	0.206
30	6.89	7.03	9.04	0.156	0.201
40	9.18	5.46	8.27	0.121	0.184
50	11.5	5.13	7.34	0.112	0.163
60	13.8	4.38	6.88	0.122	0.154
70	16.1	4.08	6.22	0.168	0.148
80	18.4	3.7	5.84	0.217	0.155
90	20.7	3.29	5.43	0.270	0.168

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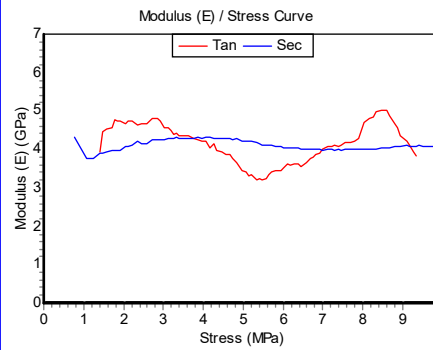
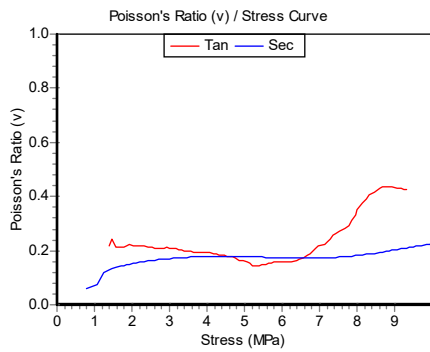
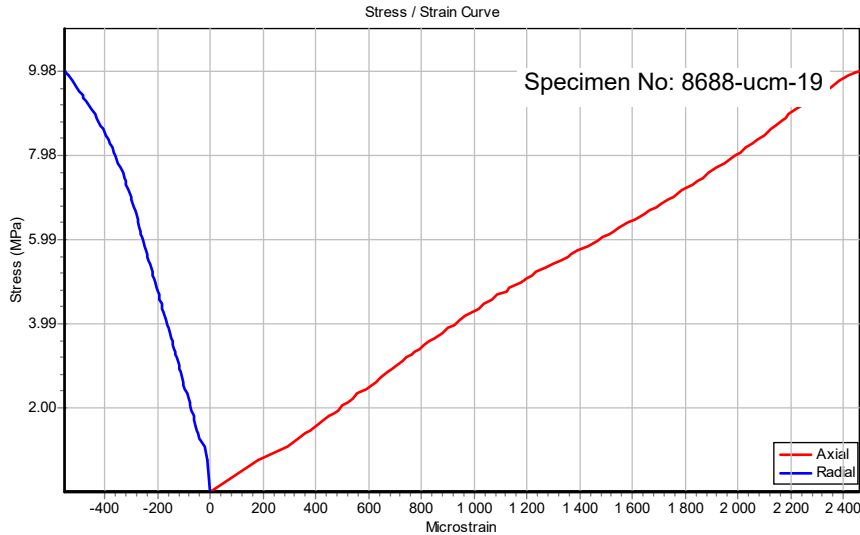
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:06:00

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 54.23 kN

Peak Strength: 9.98 MPa

Axial Strain at Failure: 2461 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.998	0	3.75	0.000	0.074
20	2	4.67	4.08	0.220	0.152
30	2.99	4.55	4.26	0.209	0.170
40	3.99	4.21	4.31	0.191	0.177
50	4.99	3.4	4.23	0.156	0.179
60	5.99	3.51	4.05	0.156	0.173
70	6.99	3.99	3.98	0.216	0.172
80	7.98	4.69	3.99	0.353	0.182
90	8.98	4.22	4.09	0.431	0.203

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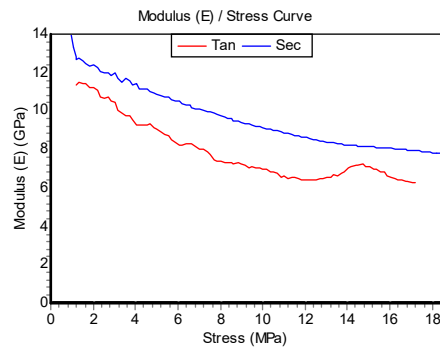
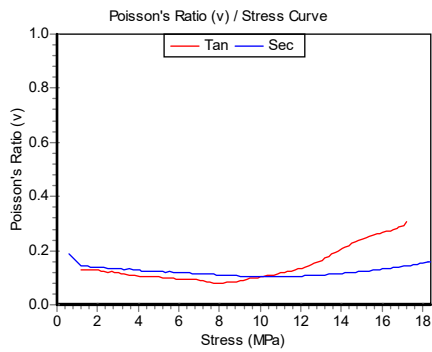
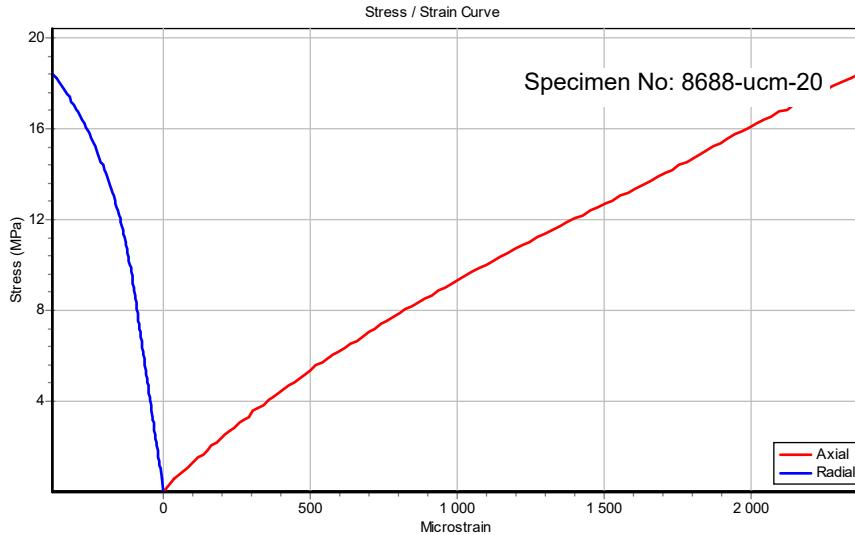
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:08:54

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 100.8 kN

Peak Strength: 18.4 MPa

Axial Strain at Failure: 2367 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.84	11.2	12.3	0.127	0.140
20	3.68	9.74	11.6	0.111	0.131
30	5.52	8.72	10.7	0.099	0.122
40	7.36	7.89	9.99	0.086	0.113
50	9.2	7.07	9.31	0.094	0.105
60	11	6.5	8.82	0.120	0.105
70	12.9	6.52	8.39	0.165	0.110
80	14.7	7.22	8.17	0.231	0.121
90	16.6	6.34	7.99	0.281	0.139

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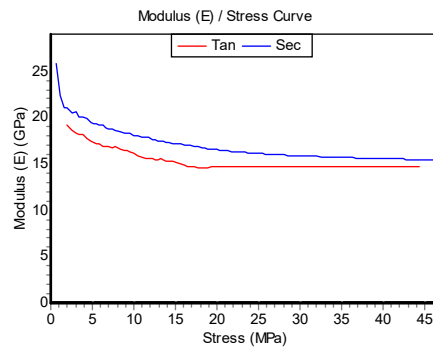
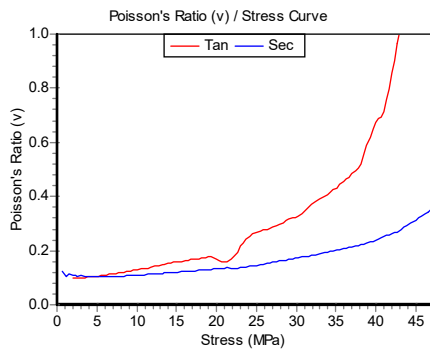
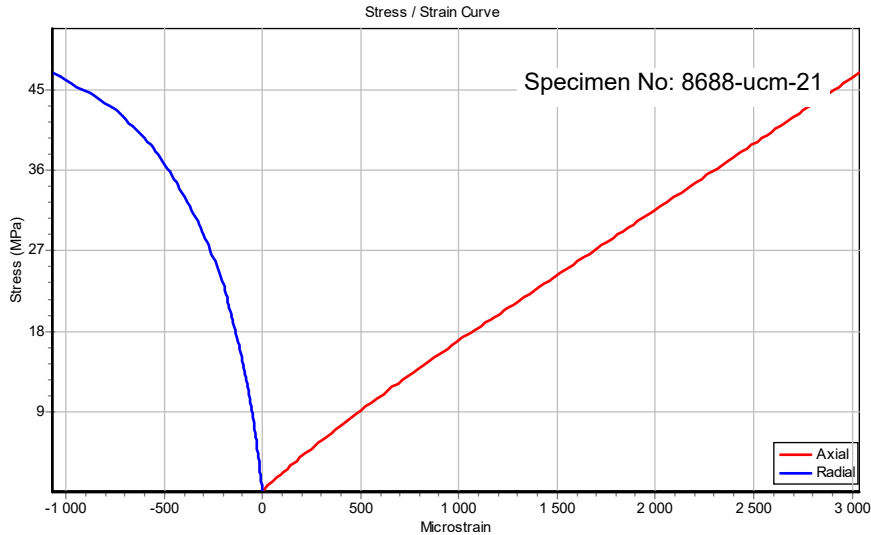
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:11:36

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 255.4 kN

Peak Strength: 46.86 MPa

Axial Strain at Failure: 3037 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.69	17.5	19.5	0.105	0.103
20	9.37	16.3	18.3	0.129	0.108
30	14.1	15.2	17.4	0.153	0.119
40	18.7	14.6	16.6	0.177	0.130
50	23.4	14.7	16.2	0.244	0.140
60	28.1	14.7	15.9	0.304	0.163
70	32.8	14.7	15.8	0.391	0.188
80	37.5	14.7	15.6	0.504	0.220
90	42.2	14.7	15.5	0.903	0.266

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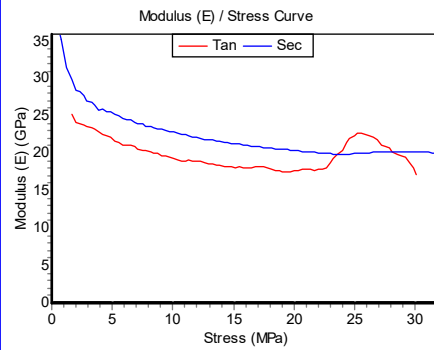
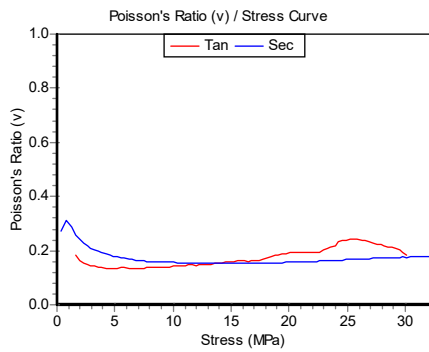
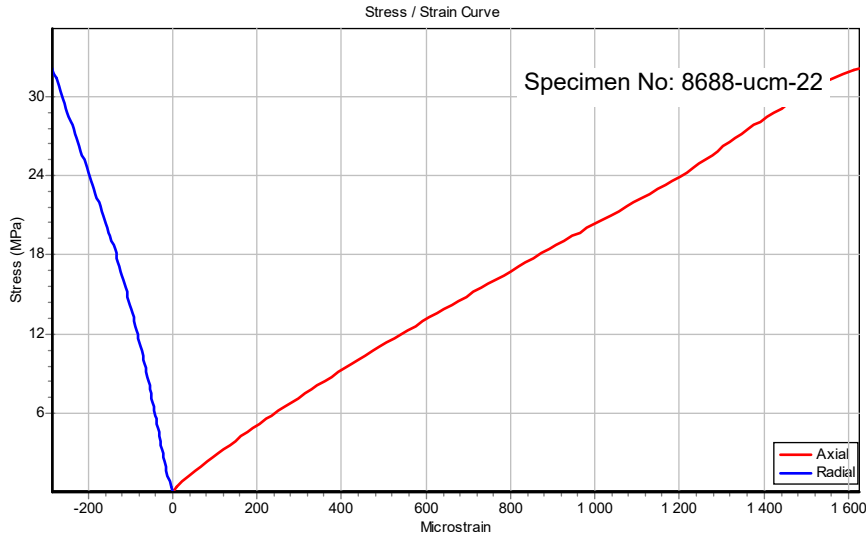
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:30:58

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 181.9 kN

Peak Strength: 32.17 MPa

Axial Strain at Failure: 1625 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.22	23.4	26.9	0.142	0.203
20	6.43	21.1	24.5	0.136	0.166
30	9.65	19.6	23	0.141	0.156
40	12.9	18.7	21.9	0.147	0.152
50	16.1	18.1	21.1	0.161	0.152
60	19.3	17.5	20.5	0.186	0.155
70	22.5	18.1	20.1	0.195	0.161
80	25.7	22.6	20.1	0.243	0.168
90	29	19.5	20.2	0.209	0.174

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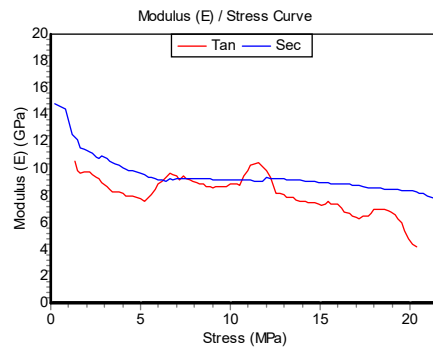
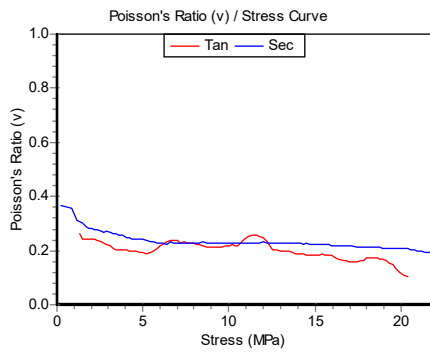
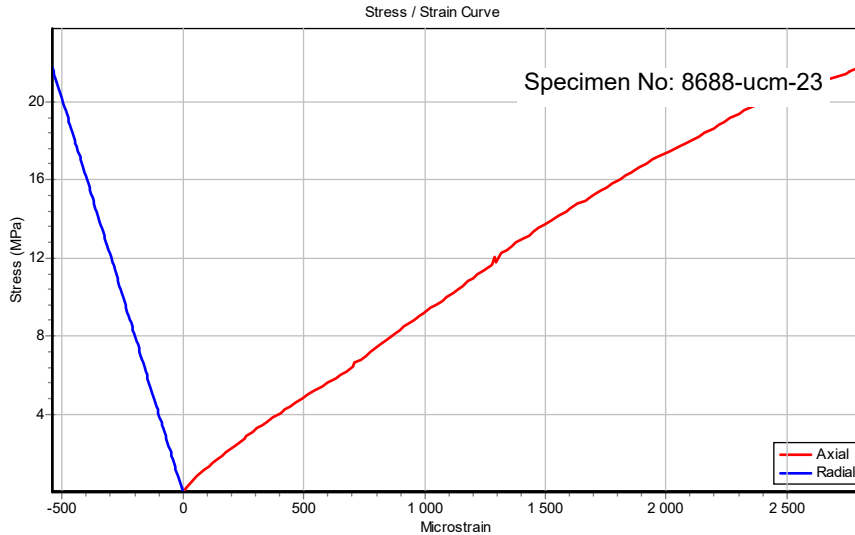
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:15:54

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 122.2 kN

Peak Strength: 21.73 MPa

Axial Strain at Failure: 2800 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.17	9.56	11.2	0.238	0.278
20	4.35	7.96	9.81	0.198	0.244
30	6.52	9.6	9.29	0.238	0.231
40	8.69	8.62	9.21	0.214	0.229
50	10.9	9.87	9.11	0.245	0.226
60	13	7.88	9.2	0.196	0.229
70	15.2	7.36	8.95	0.183	0.222
80	17.4	6.42	8.64	0.160	0.215
90	19.6	5.33	8.38	0.132	0.208

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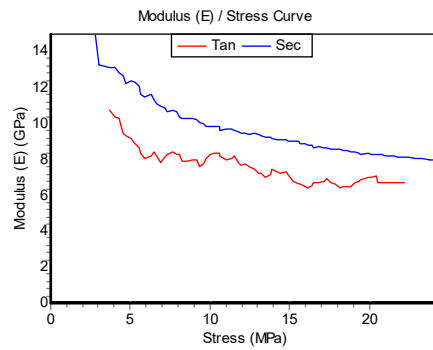
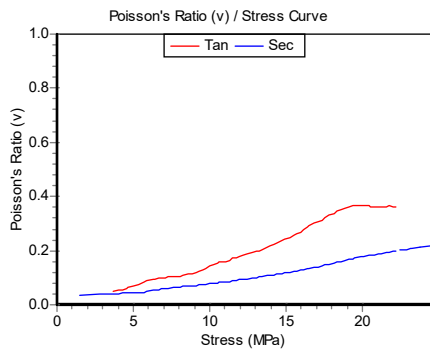
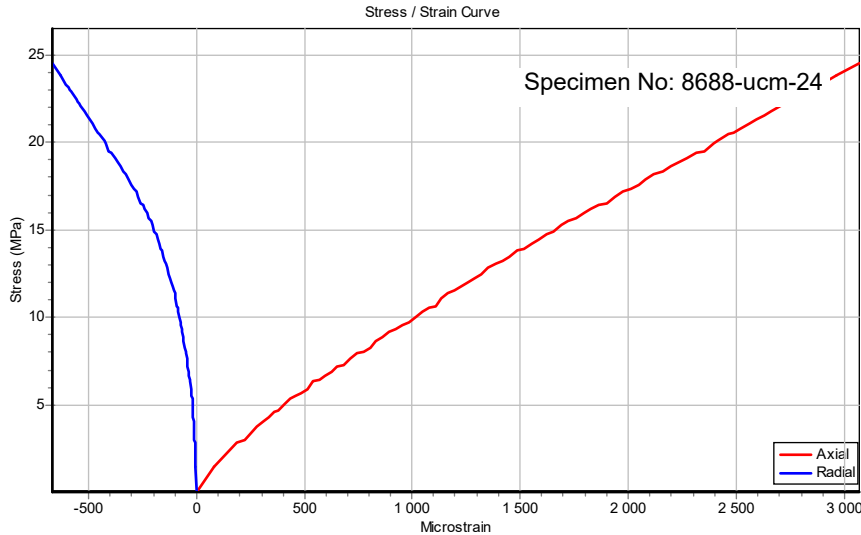
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:36:20

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 45.84 kN

Peak Strength: 24.49 MPa

Axial Strain at Failure: 3071 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.45	0	15.1	0.000	0.039
20	4.9	9.19	12.4	0.068	0.043
30	7.35	8.41	10.7	0.102	0.063
40	9.8	8.31	9.84	0.142	0.077
50	12.2	7.61	9.42	0.187	0.095
60	14.7	7.28	9.11	0.236	0.115
70	17.1	6.94	8.63	0.314	0.144
80	19.6	6.98	8.33	0.364	0.176
90	22	6.72	8.13	0.363	0.199

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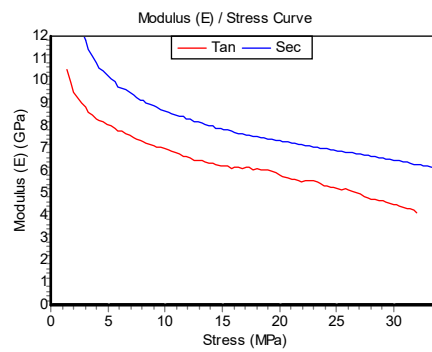
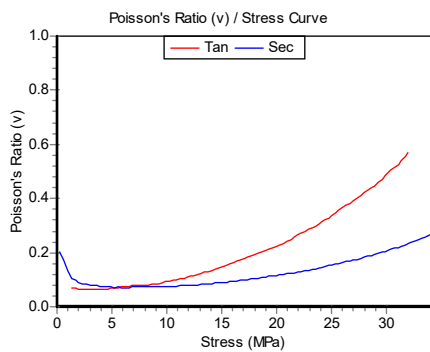
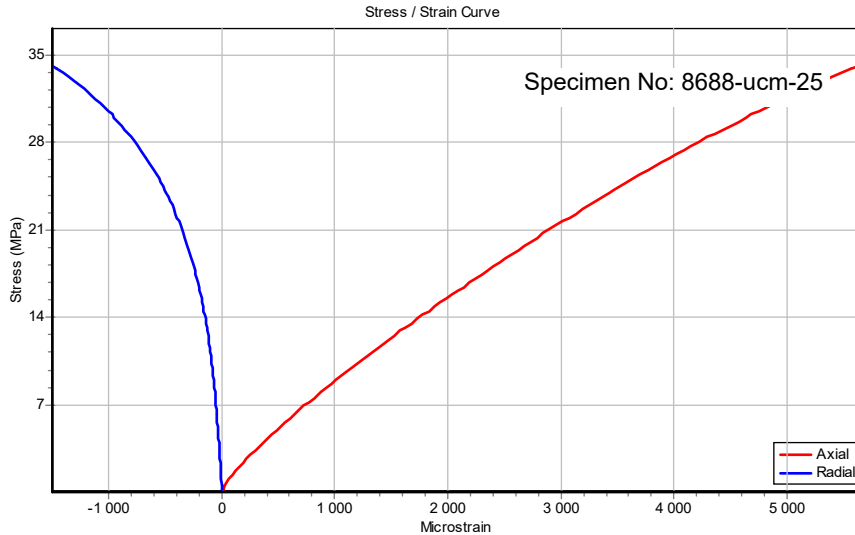
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:16:15

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 191.5 kN

Peak Strength: 34.09 MPa

Axial Strain at Failure: 5640 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.41	8.48	11.1	0.064	0.077
20	6.82	7.6	9.48	0.077	0.073
30	10.2	6.93	8.61	0.096	0.074
40	13.6	6.34	8.02	0.131	0.084
50	17	6.14	7.6	0.178	0.099
60	20.5	5.68	7.28	0.235	0.120
70	23.9	5.33	6.97	0.305	0.144
80	27.3	4.84	6.7	0.403	0.175
90	30.7	4.37	6.39	0.515	0.216

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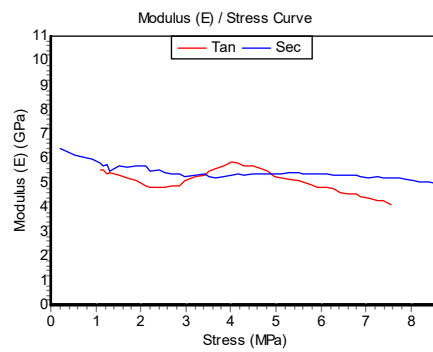
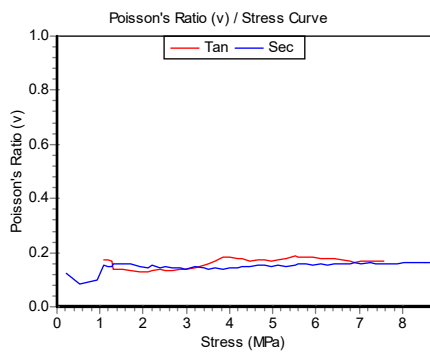
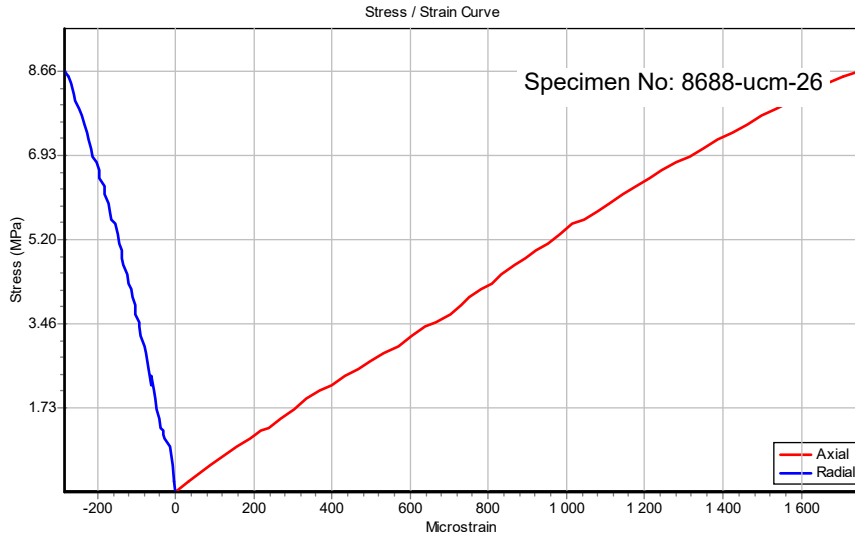
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:18:39

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 48.59 kN

Peak Strength: 8.66 MPa

Axial Strain at Failure: 1749 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.866	0	5.99	0.000	0.098
20	1.73	5.1	5.7	0.131	0.149
30	2.6	4.87	5.37	0.135	0.146
40	3.46	5.47	5.25	0.160	0.141
50	4.33	5.7	5.37	0.168	0.150
60	5.2	5.14	5.4	0.176	0.150
70	6.06	4.79	5.35	0.176	0.158
80	6.93	4.38	5.22	0.169	0.159
90	7.79	0	5.13	0.000	0.160

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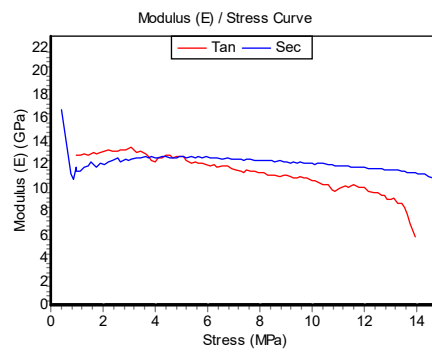
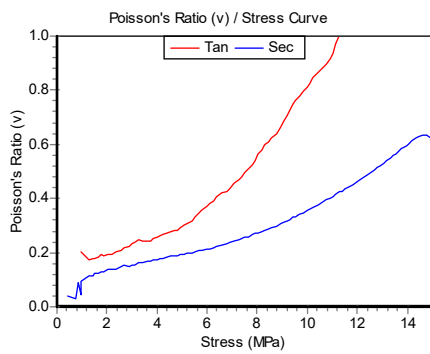
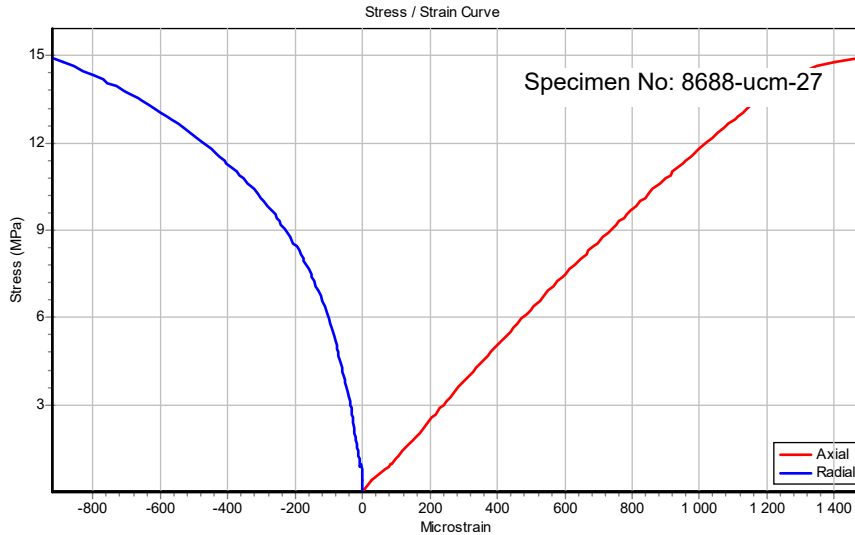
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:21:23

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 83.82 kN

Peak Strength: 14.93 MPa

Axial Strain at Failure: 1474 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.49	12.9	12.2	0.180	0.124
20	2.99	13.4	12.4	0.232	0.153
30	4.48	12.8	12.6	0.279	0.186
40	5.97	11.9	12.6	0.379	0.215
50	7.46	11.5	12.5	0.493	0.255
60	8.96	11.1	12.2	0.684	0.312
70	10.5	10.3	12	0.883	0.385
80	11.9	10	11.7	1.127	0.465
90	13.4	8.67	11.4	1.306	0.560

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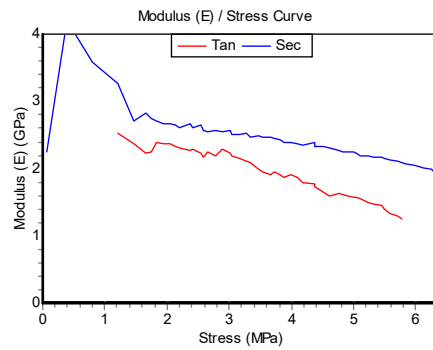
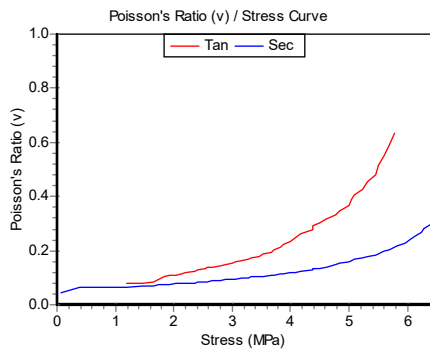
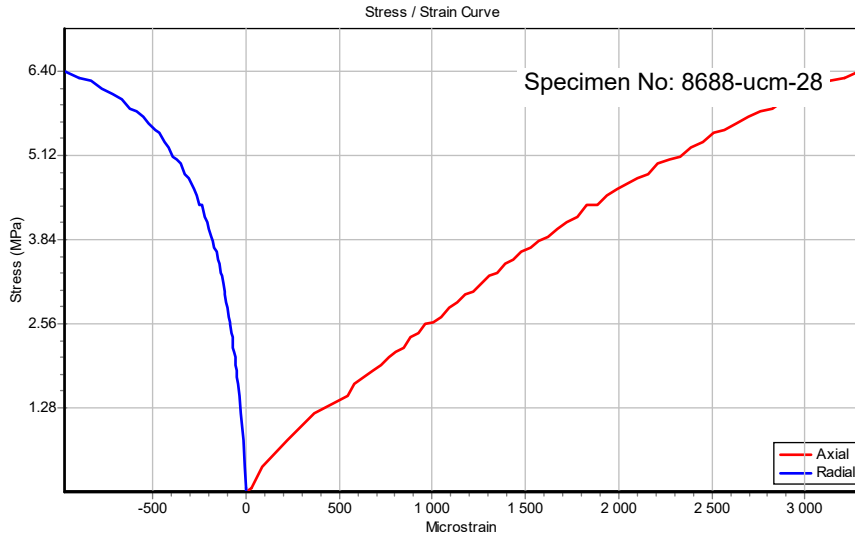
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:22:34

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 30.92 kN

Peak Strength: 6.4 MPa

Axial Strain at Failure: 3291 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	0.64	0	3.58	0.000	0.065
20	1.28	2.37	2.7	0.080	0.069
30	1.92	2.37	2.66	0.107	0.076
40	2.56	2.18	2.57	0.137	0.086
50	3.2	2.12	2.52	0.168	0.100
60	3.84	1.88	2.4	0.224	0.116
70	4.48	1.65	2.32	0.304	0.136
80	5.12	1.5	2.19	0.428	0.173
90	5.76	1.25	2.09	0.632	0.212

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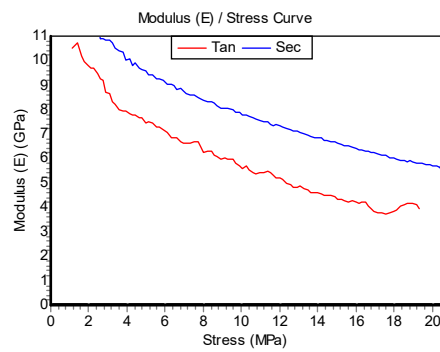
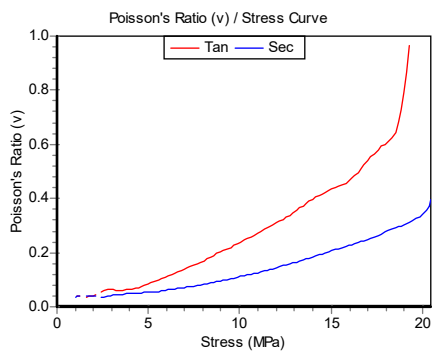
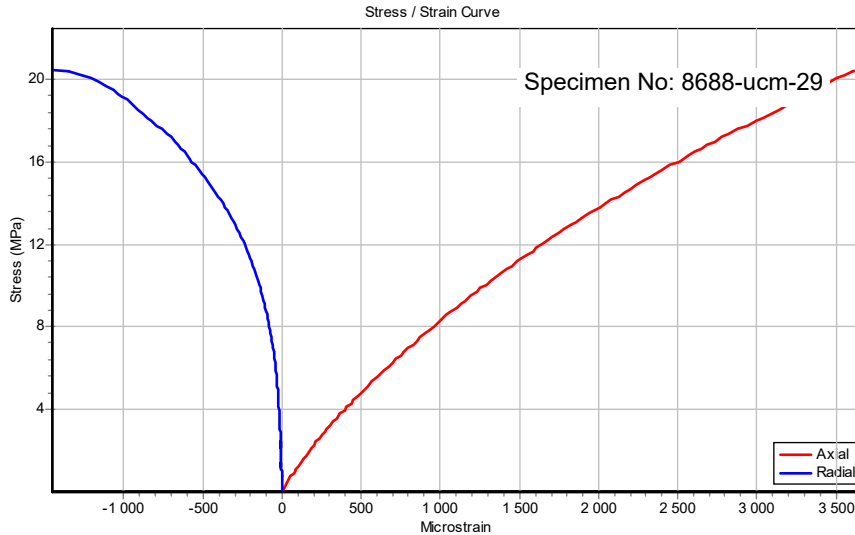
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:22:53

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 103.3 kN

Peak Strength: 20.45 MPa

Axial Strain at Failure: 3646 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.04	9.67	11.4	0.044	0.042
20	4.09	7.82	10.1	0.064	0.049
30	6.13	6.85	9.01	0.119	0.063
40	8.18	6.27	8.34	0.176	0.085
50	10.2	5.68	7.79	0.246	0.114
60	12.3	5	7.25	0.323	0.151
70	14.3	4.51	6.74	0.411	0.191
80	16.4	4.23	6.31	0.497	0.237
90	18.4	4.11	5.91	0.643	0.290

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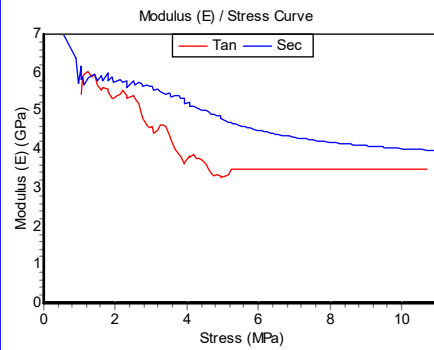
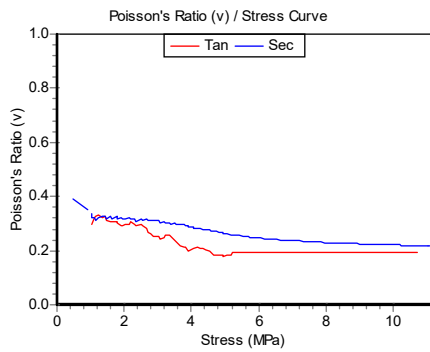
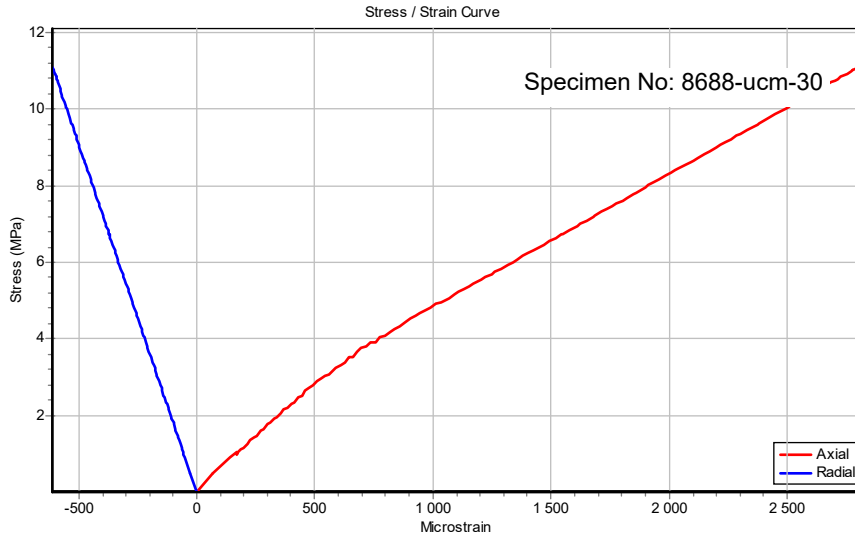
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UNIAXIAL COMPRESSION TEST

2021/10/08 08:25:48

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 63.79 kN

Peak Strength: 11.11 MPa

Axial Strain at Failure: 2806 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.11	5.97	5.69	0.328	0.313
20	2.22	5.39	5.79	0.296	0.318
30	3.33	4.58	5.43	0.252	0.299
40	4.44	3.62	5.03	0.199	0.277
50	5.55	3.48	4.59	0.191	0.252
60	6.67	3.48	4.35	0.191	0.240
70	7.78	3.48	4.21	0.191	0.232
80	8.89	3.48	4.1	0.191	0.226
90	10	3.48	4.02	0.191	0.221

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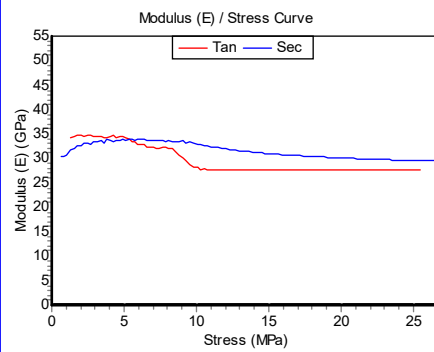
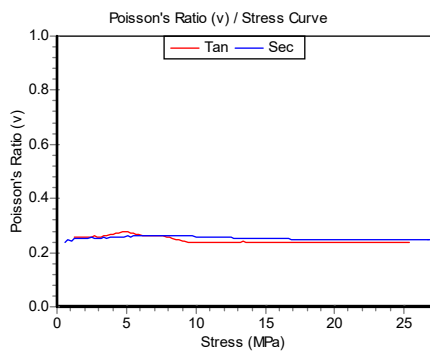
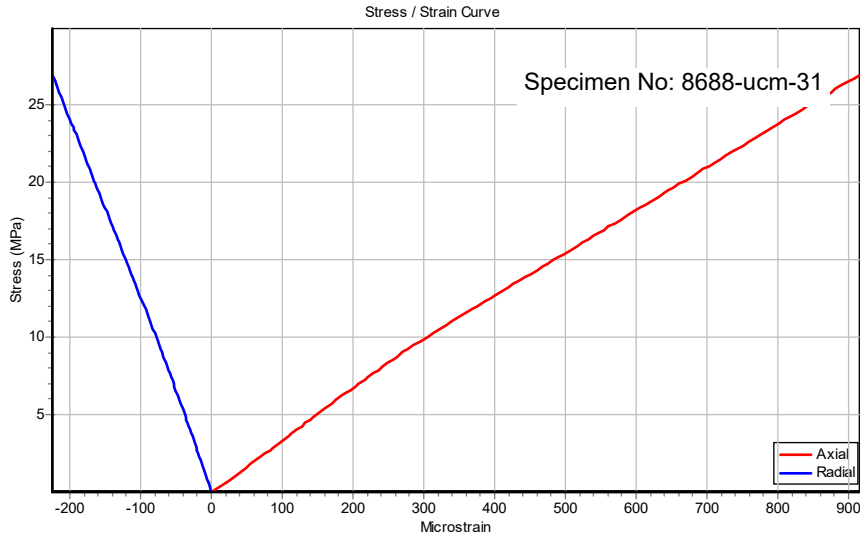
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:40:40

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 149.2 kN

Peak Strength: 26.91 MPa

Axial Strain at Failure: 915 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.69	34.4	33.4	0.258	0.254
20	5.38	33.3	34	0.272	0.261
30	8.07	32.1	33.5	0.255	0.261
40	10.8	27.6	32.5	0.240	0.257
50	13.5	27.6	31.4	0.240	0.253
60	16.1	27.6	30.7	0.240	0.251
70	18.8	27.6	30.2	0.240	0.249
80	21.5	27.6	29.9	0.240	0.248
90	24.2	27.6	29.6	0.240	0.247

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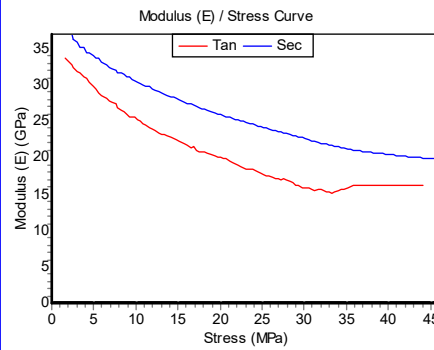
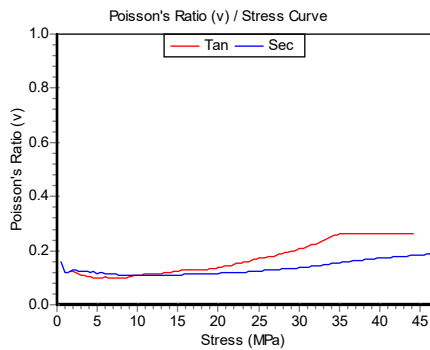
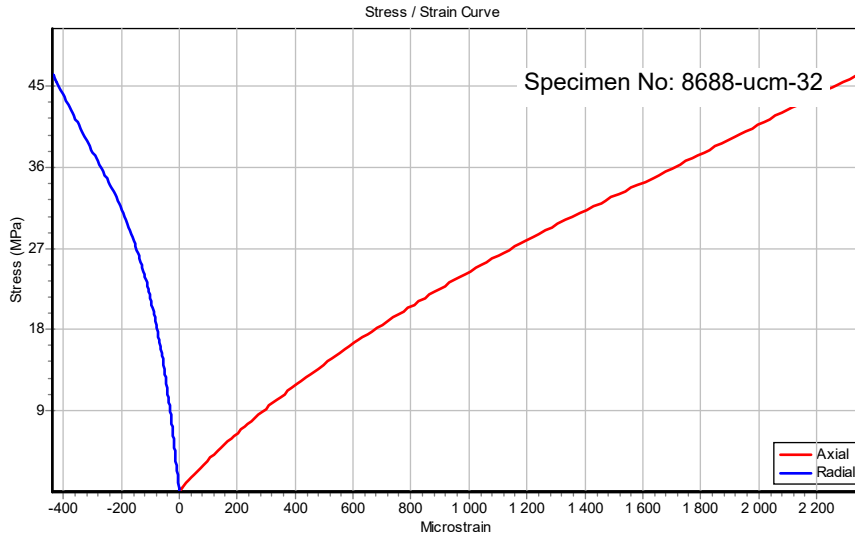
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:25:42

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 257.4 kN

Peak Strength: 46.34 MPa

Axial Strain at Failure: 2347 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.63	29.8	34	0.101	0.116
20	9.27	25.6	30.8	0.107	0.108
30	13.9	22.8	28.4	0.121	0.110
40	18.5	20.5	26.5	0.131	0.115
50	23.2	18.3	24.7	0.158	0.121
60	27.8	16.9	23.3	0.190	0.132
70	32.4	15.3	21.9	0.232	0.146
80	37.1	16.2	20.8	0.262	0.163
90	41.7	16.2	20.2	0.262	0.177

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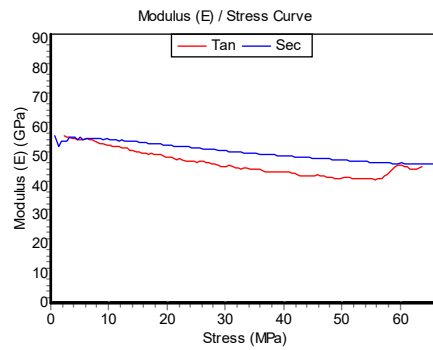
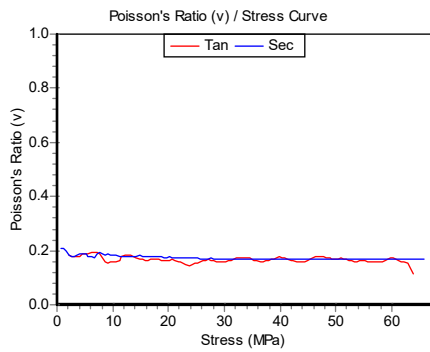
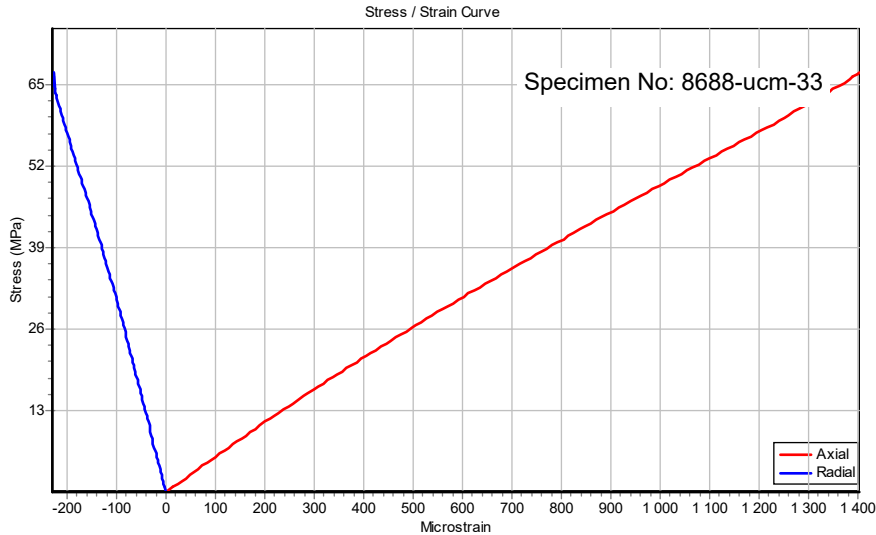
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:26:00

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 373.8 kN

Peak Strength: 67.02 MPa

Axial Strain at Failure: 1402 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	6.7	55.8	56.3	0.195	0.186
20	13.4	52.3	55.2	0.177	0.177
30	20.1	49.9	54.1	0.164	0.176
40	26.8	47.9	52.6	0.168	0.170
50	33.5	46.1	51.5	0.172	0.169
60	40.2	44.9	50.3	0.173	0.168
70	46.9	43.2	49.3	0.179	0.168
80	53.6	42.4	48.4	0.159	0.168
90	60.3	46.8	47.8	0.168	0.167

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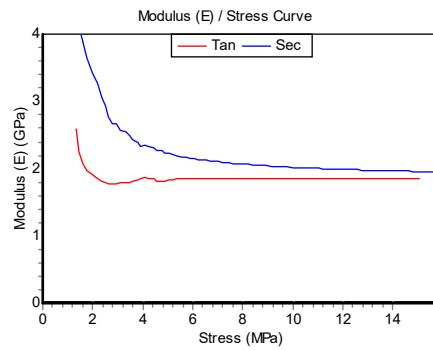
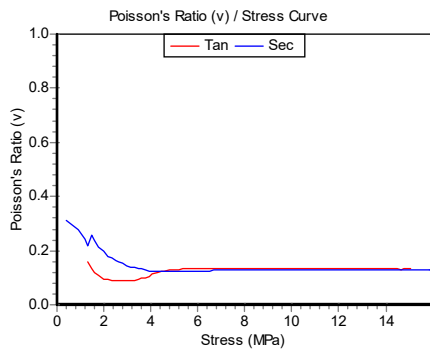
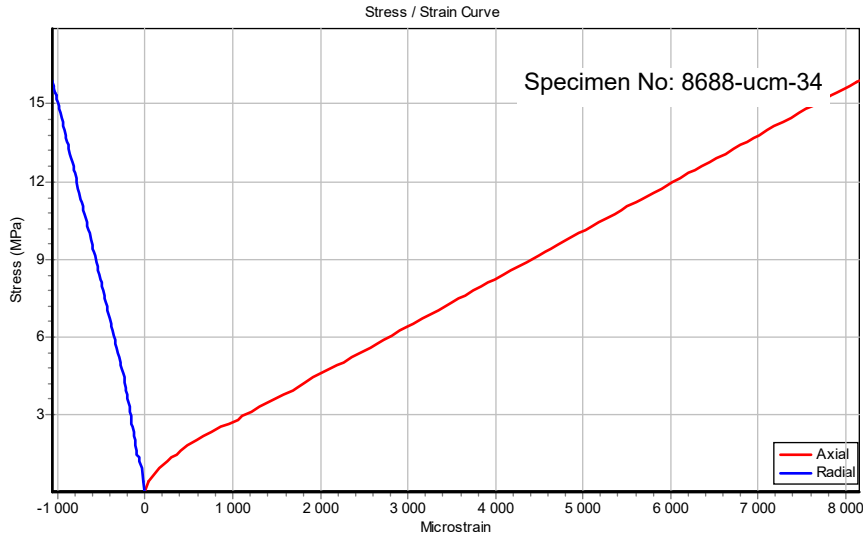
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:51:38

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 83.83 kN

Peak Strength: 15.91 MPa

Axial Strain at Failure: 8151 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.59	1.96	3.65	0.108	0.215
20	3.18	1.79	2.54	0.090	0.137
30	4.77	1.81	2.23	0.131	0.124
40	6.36	1.85	2.13	0.132	0.126
50	7.96	1.85	2.06	0.132	0.128
60	9.55	1.85	2.03	0.132	0.128
70	11.1	1.85	2	0.132	0.129
80	12.7	1.85	1.98	0.132	0.129
90	14.3	1.85	1.96	0.132	0.129

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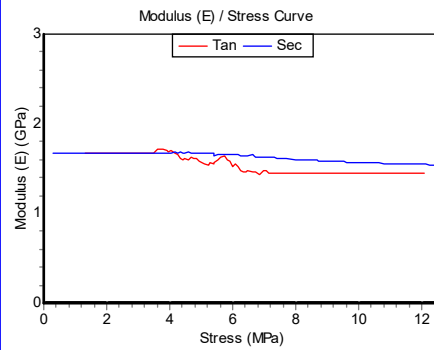
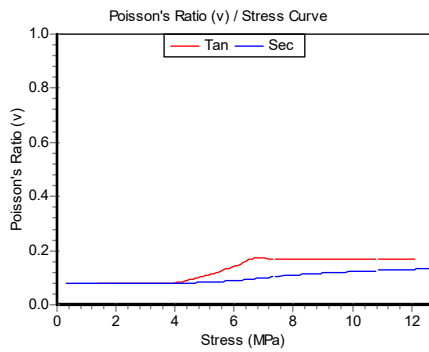
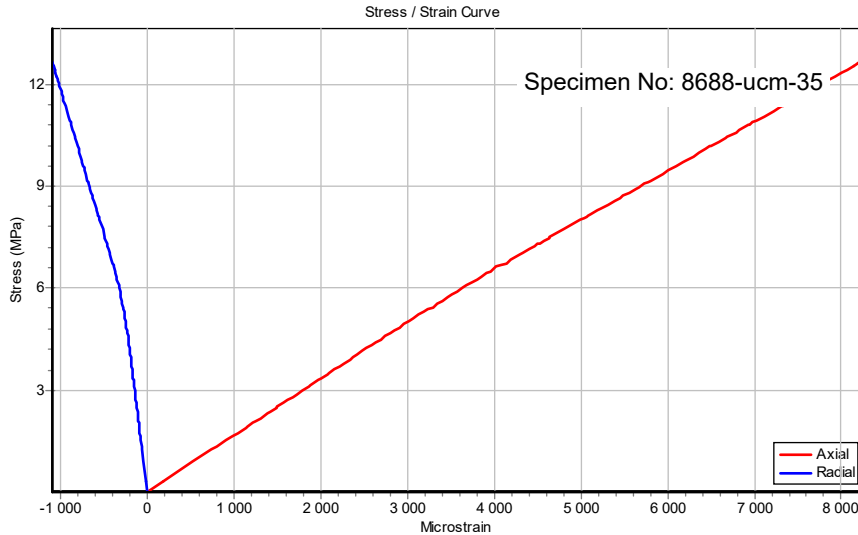
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:48:31

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 65.36 kN

Peak Strength: 12.65 MPa

Axial Strain at Failure: 8209 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.27	1.67	1.67	0.081	0.081
20	2.53	1.67	1.67	0.081	0.081
30	3.8	1.7	1.67	0.081	0.081
40	5.06	1.56	1.67	0.109	0.083
50	6.33	1.47	1.65	0.158	0.092
60	7.59	1.44	1.61	0.170	0.107
70	8.86	1.44	1.58	0.170	0.116
80	10.1	1.44	1.57	0.170	0.123
90	11.4	1.44	1.55	0.170	0.129

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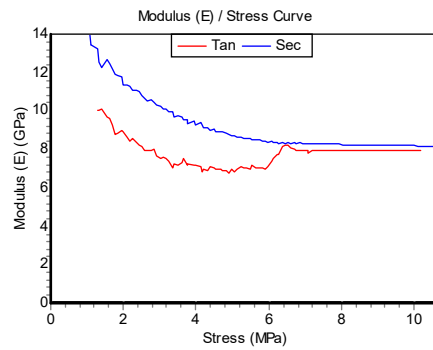
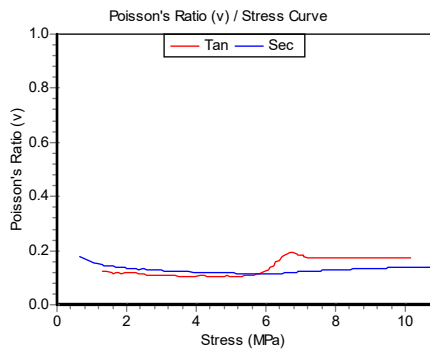
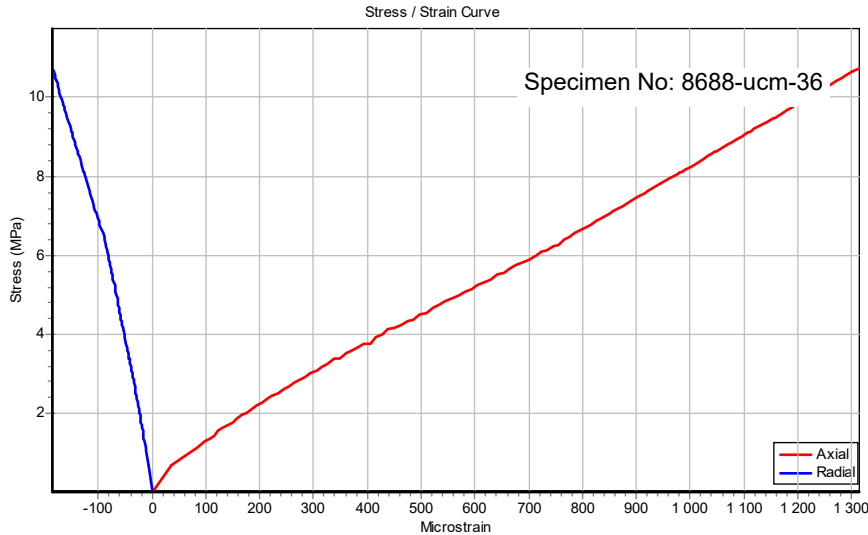
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:30:08

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 59.73 kN

Peak Strength: 10.74 MPa

Axial Strain at Failure: 1315 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.07	0	13.4	0.000	0.151
20	2.15	8.43	11.3	0.118	0.135
30	3.22	7.39	9.94	0.111	0.126
40	4.3	6.89	9.13	0.104	0.119
50	5.37	7.03	8.57	0.107	0.116
60	6.44	8.19	8.32	0.176	0.116
70	7.52	7.94	8.27	0.175	0.126
80	8.59	7.94	8.23	0.175	0.132
90	9.67	7.94	8.2	0.174	0.137

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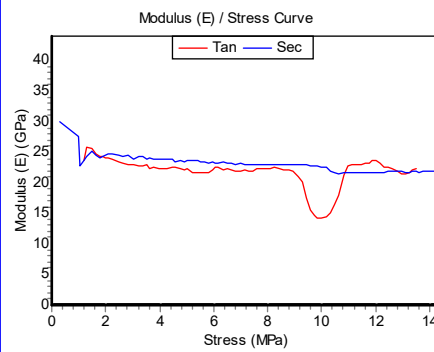
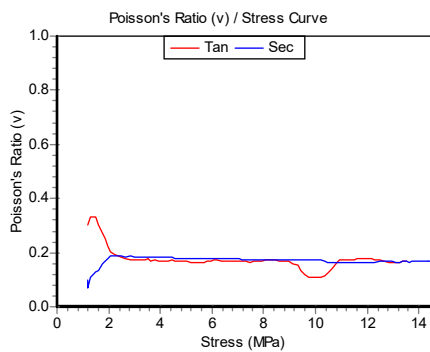
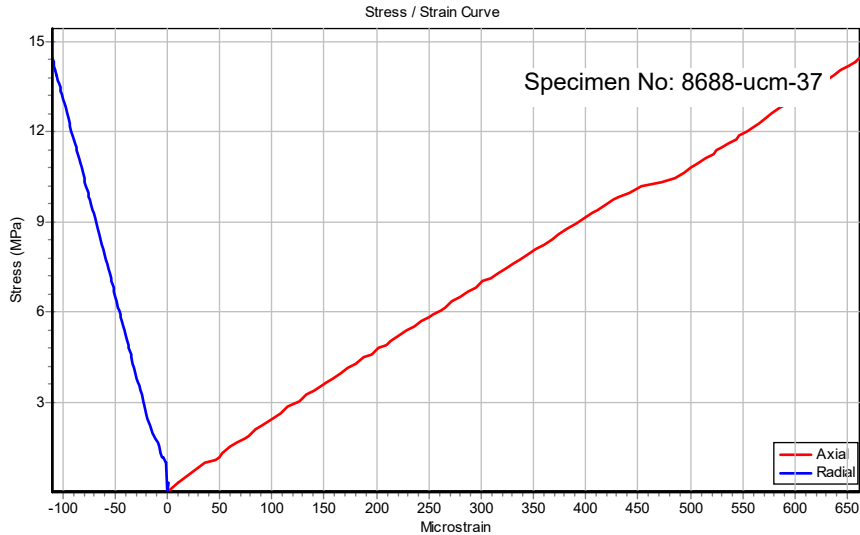
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:32:35

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 78.98 kN

Peak Strength: 14.45 MPa

Axial Strain at Failure: 661 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.44	25.7	25.2	0.330	0.128
20	2.89	22.9	24	0.174	0.182
30	4.33	22.6	23.9	0.172	0.181
40	5.78	21.8	23.2	0.166	0.176
50	7.22	21.9	23	0.166	0.175
60	8.67	22.1	22.9	0.168	0.174
70	10.1	14.5	22.5	0.110	0.171
80	11.6	23.2	21.7	0.177	0.165
90	13	21.5	21.8	0.164	0.165

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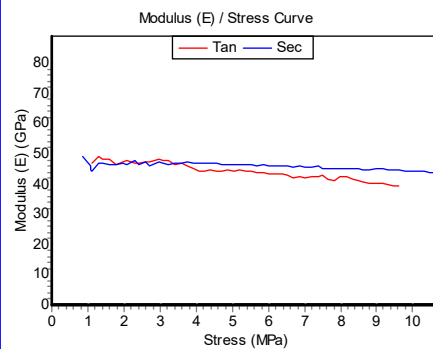
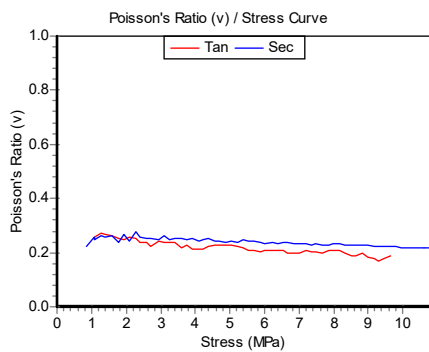
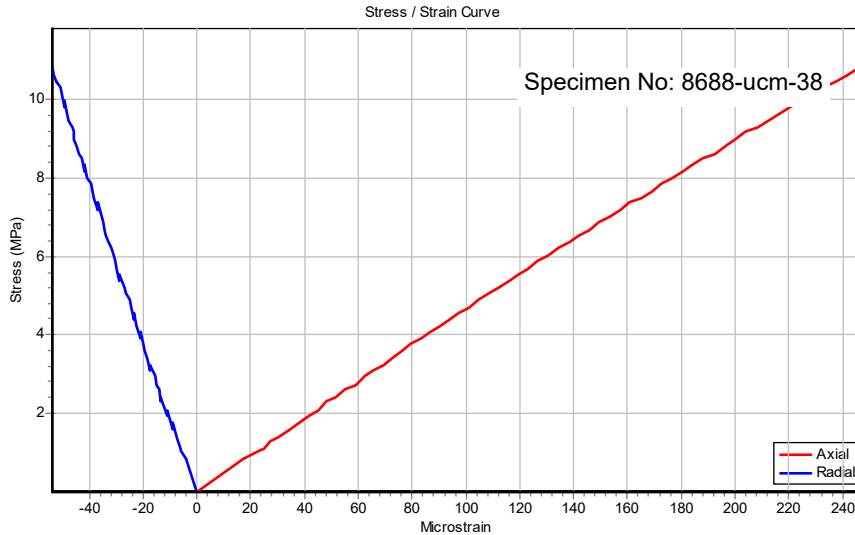
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:32:54

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 60.25 kN

Peak Strength: 10.8 MPa

Axial Strain at Failure: 246 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.08	46.8	44.3	0.257	0.249
20	2.16	47.1	47.7	0.253	0.278
30	3.24	46.6	47	0.238	0.251
40	4.32	44.5	46.9	0.225	0.251
50	5.4	44.4	46.3	0.208	0.241
60	6.48	43	46	0.208	0.237
70	7.56	41.7	45.3	0.199	0.230
80	8.64	40.4	44.9	0.199	0.227
90	9.72	0	44.4	0.000	0.224

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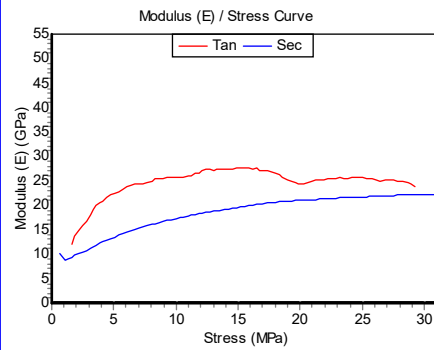
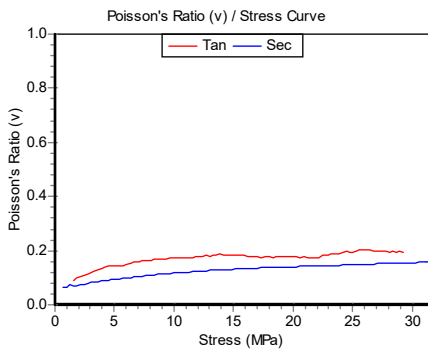
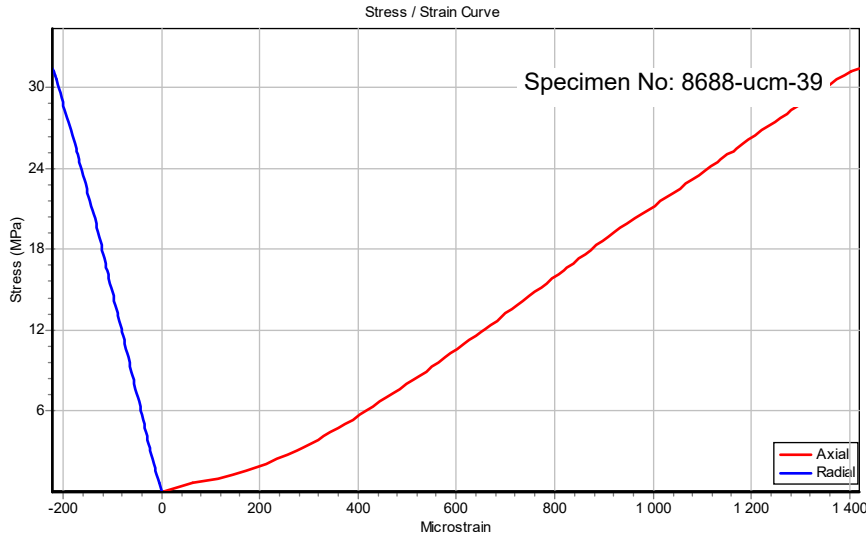
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:33:17

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 175.6 kN

Peak Strength: 31.38 MPa

Axial Strain at Failure: 1419 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.14	19.1	11.5	0.126	0.084
20	6.28	24	14.8	0.153	0.101
30	9.41	25.7	17.1	0.171	0.115
40	12.6	27.3	18.7	0.181	0.125
50	15.7	27.7	19.9	0.182	0.134
60	18.8	25.3	20.8	0.177	0.140
70	22	25.3	21.3	0.175	0.144
80	25.1	25.6	21.7	0.200	0.148
90	28.2	24.9	22.1	0.196	0.153

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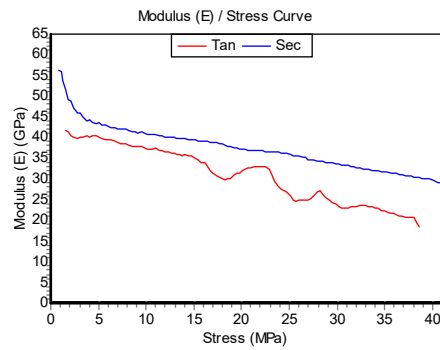
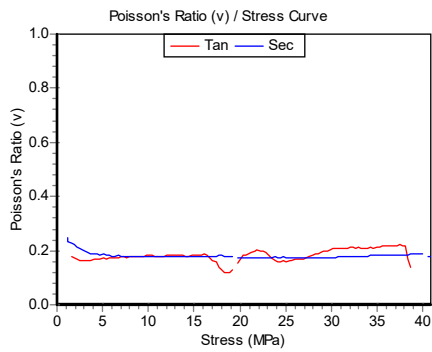
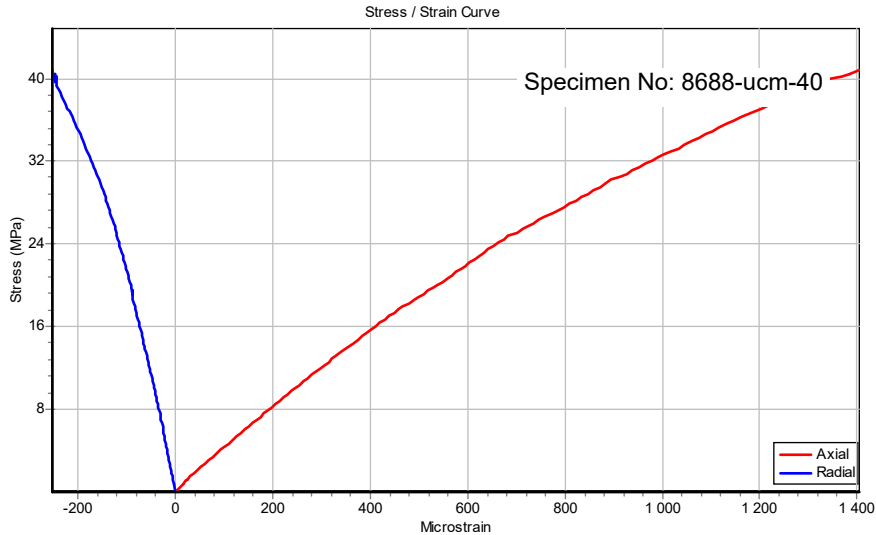
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:33:31

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 228.4 kN

Peak Strength: 40.85 MPa

Axial Strain at Failure: 1405 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.09	40.3	43.6	0.166	0.186
20	8.17	38.2	41.7	0.177	0.179
30	12.3	36.5	40.3	0.181	0.179
40	16.3	33.1	39	0.183	0.180
50	20.4	32.6	37	0.185	0.172
60	24.5	26.8	36.2	0.161	0.176
70	28.6	25.5	34.1	0.195	0.174
80	32.7	23.5	32.3	0.212	0.179
90	36.8	20.9	31	0.218	0.183

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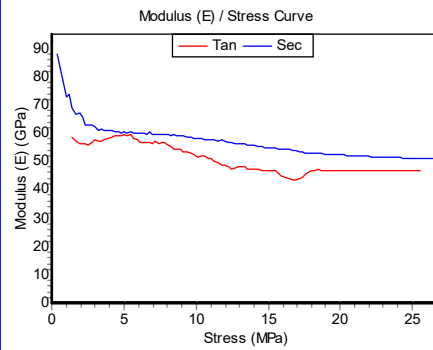
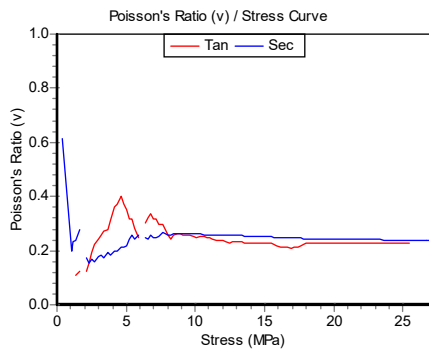
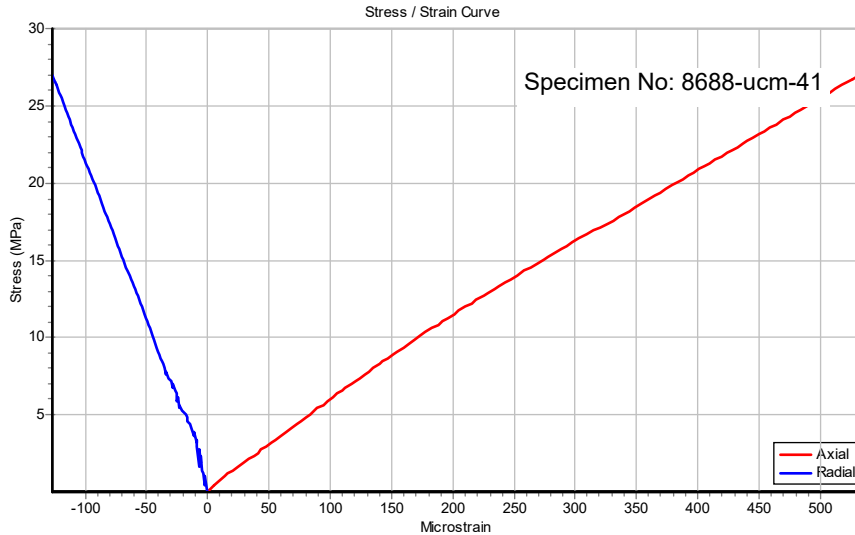
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UNIAXIAL COMPRESSION TEST

2021/10/05 09:42:39

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 149.7 kN

Peak Strength: 27.01 MPa

Axial Strain at Failure: 532 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.7	56.7	62.9	0.224	0.156
20	5.4	59.3	60.7	0.316	0.257
30	8.1	55.2	59.1	0.242	0.259
40	10.8	50.9	57.7	0.246	0.259
50	13.5	47.4	55.9	0.229	0.254
60	16.2	44	54.1	0.213	0.249
70	18.9	47	52.6	0.227	0.244
80	21.6	46.9	51.8	0.227	0.242
90	24.3	46.9	51.3	0.227	0.240

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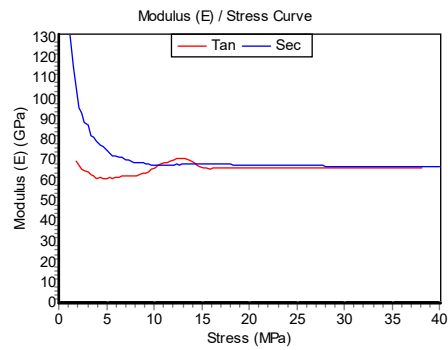
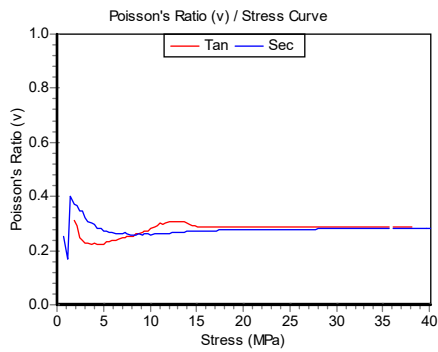
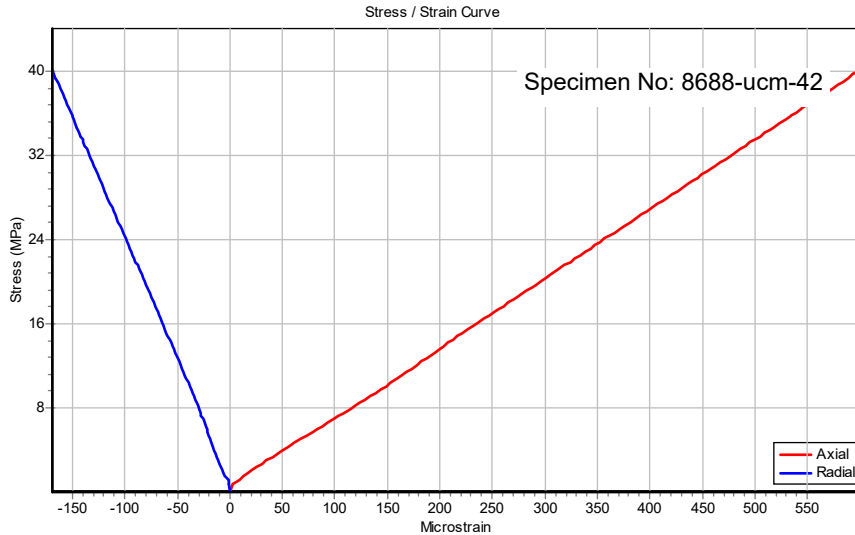
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:43:06

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 224.2 kN

Peak Strength: 40.13 MPa

Axial Strain at Failure: 599 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.01	61.6	77.3	0.223	0.283
20	8.03	62.2	68.9	0.251	0.258
30	12	70.2	67.9	0.305	0.264
40	16.1	66.1	68.2	0.288	0.274
50	20.1	66.1	67.8	0.288	0.276
60	24.1	66	67.5	0.288	0.278
70	28.1	66.2	67.3	0.288	0.280
80	32.1	66.2	67.1	0.287	0.281
90	36.1	66.2	67	0.287	0.281

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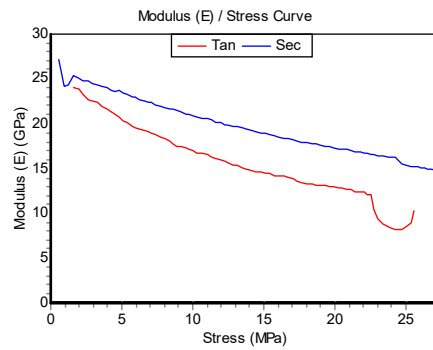
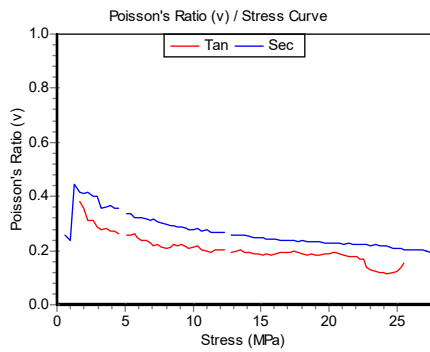
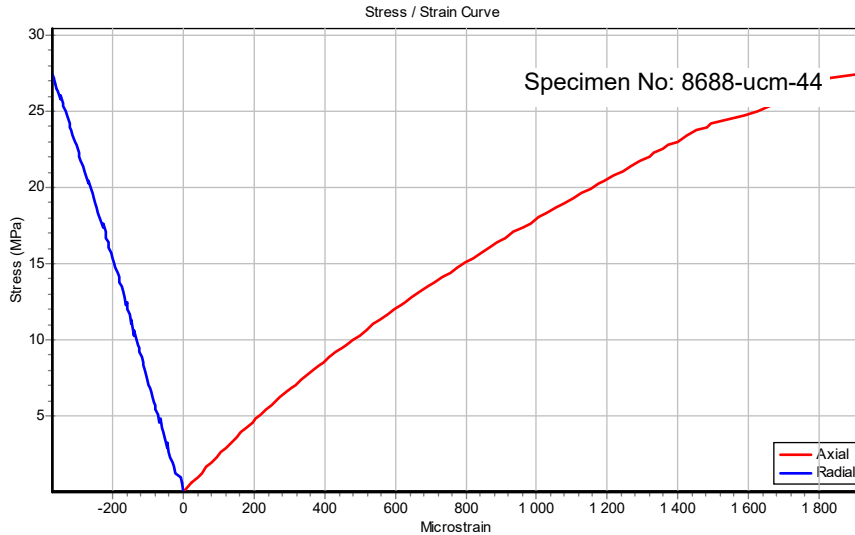
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:38:40

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 151.4 kN

Peak Strength: 27.46 MPa

Axial Strain at Failure: 1915 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.75	22.6	24.5	0.289	0.399
20	5.49	19.6	23	0.262	0.323
30	8.24	18.1	21.6	0.213	0.293
40	11	16.5	20.5	0.197	0.275
50	13.7	14.9	19.4	0.192	0.256
60	16.5	14	18.3	0.193	0.240
70	19.2	13.1	17.5	0.184	0.231
80	22	12.4	16.7	0.177	0.224
90	24.7	8.24	15.6	0.120	0.208

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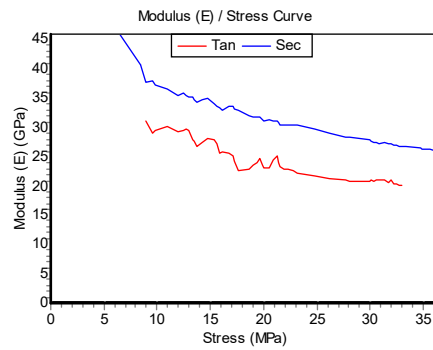
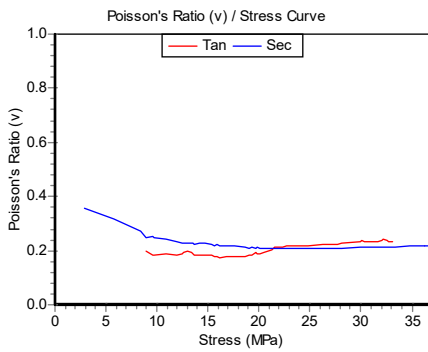
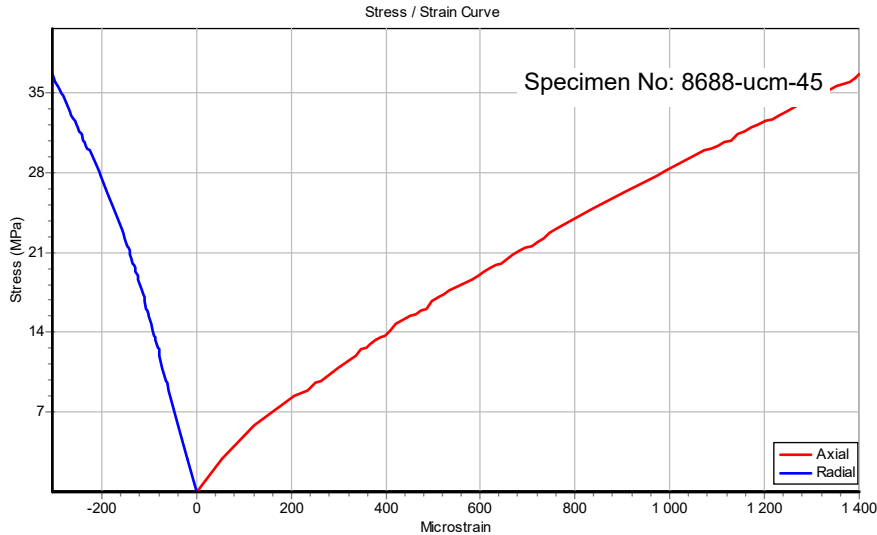
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UNIAXIAL COMPRESSION TEST

2021/10/08 08:06:44

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 28.03 kN

Peak Strength: 36.64 MPa

Axial Strain at Failure: 1400 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.66	0	47.7	0.000	0.315
20	7.33	0	40.9	0.000	0.270
30	11	29.3	35.5	0.184	0.231
40	14.7	28.2	35.1	0.183	0.227
50	18.3	23	32	0.178	0.212
60	22	22.8	30.4	0.213	0.208
70	25.6	21.4	29.1	0.221	0.210
80	29.3	20.9	27.9	0.231	0.211
90	33	20.2	26.8	0.234	0.215

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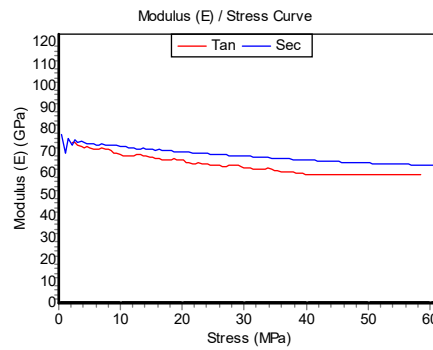
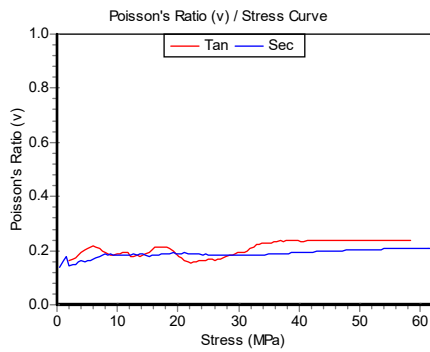
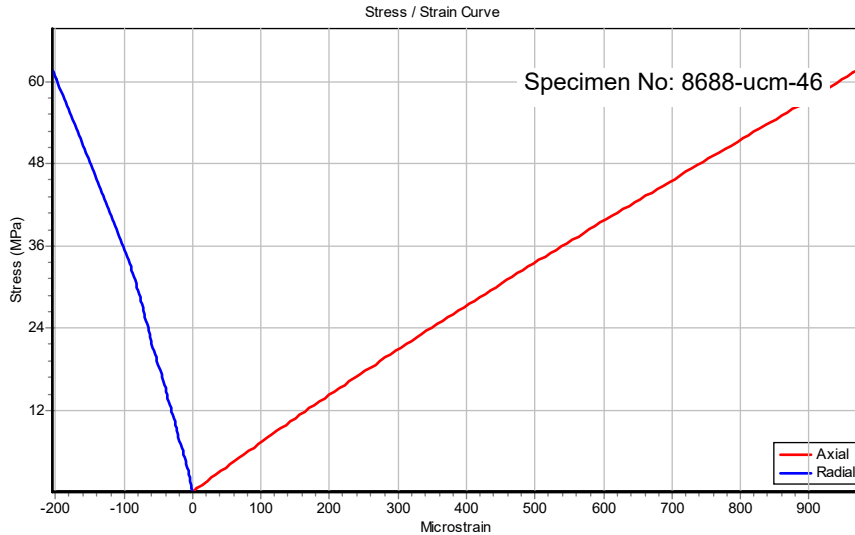
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UNIAXIAL COMPRESSION TEST

2021/09/29 11:36:47

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 343.8 kN

Peak Strength: 61.76 MPa

Axial Strain at Failure: 973 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	6.18	71.2	72.8	0.211	0.172
20	12.4	68.2	71.2	0.179	0.186
30	18.5	66.5	69.8	0.209	0.189
40	24.7	63.6	68.7	0.170	0.184
50	30.9	62.2	67.6	0.194	0.183
60	37.1	60.2	66.3	0.235	0.189
70	43.2	59.3	65.4	0.239	0.196
80	49.4	59.3	64.5	0.239	0.202
90	55.6	59.3	63.9	0.239	0.207

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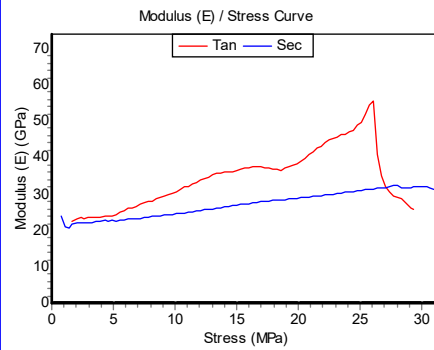
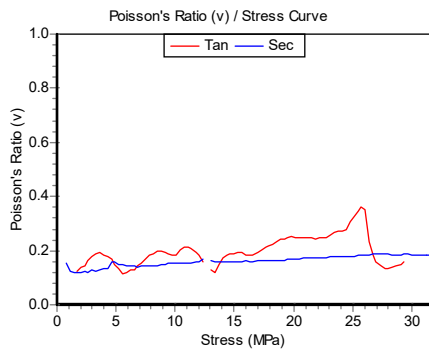
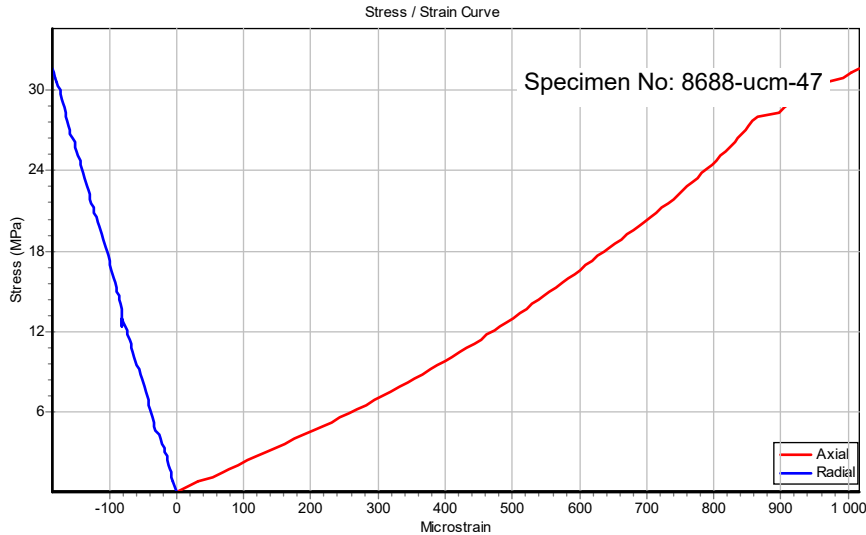
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:31:47

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 177.9 kN

Peak Strength: 31.61 MPa

Axial Strain at Failure: 1017 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.16	23.4	22.1	0.186	0.123
20	6.32	26.3	23.1	0.130	0.146
30	9.48	30.2	24.4	0.183	0.152
40	12.6	34.5	25.8	0.000	0.000
50	15.8	37.2	27.3	0.181	0.161
60	19	37.5	28.7	0.243	0.165
70	22.1	44.1	29.7	0.249	0.173
80	25.3	51.8	31.1	0.347	0.183
90	28.4	27.7	31.7	0.144	0.184

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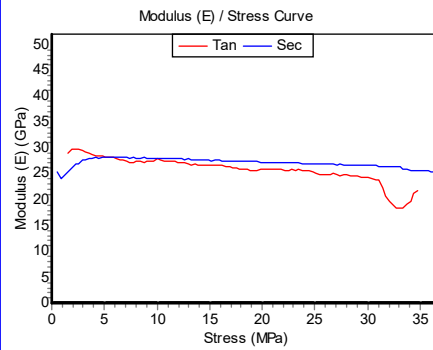
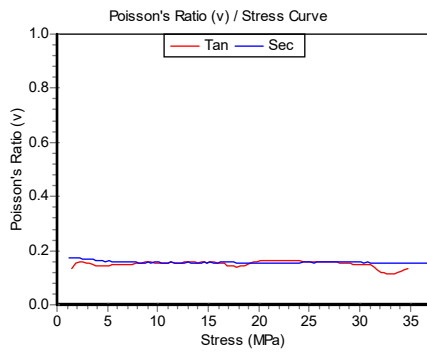
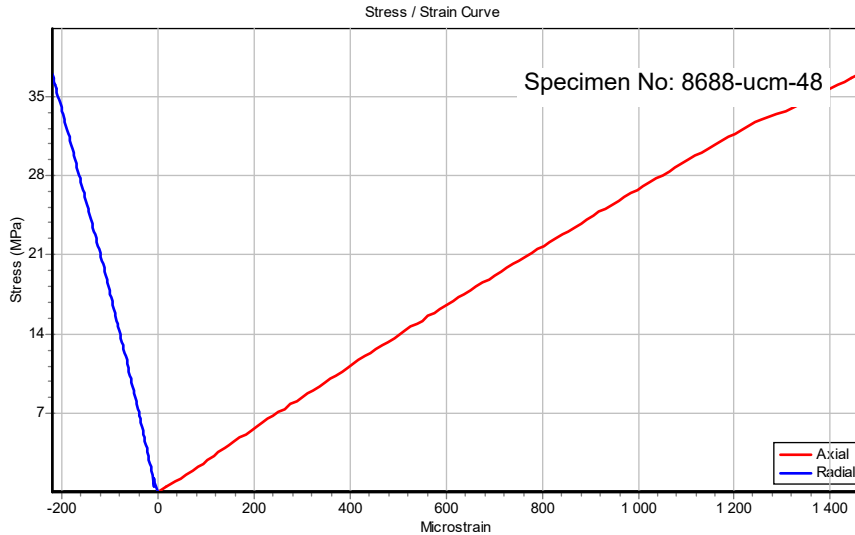
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:42:37

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 206.8 kN

Peak Strength: 37.05 MPa

Axial Strain at Failure: 1460 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	3.7	28.7	27.9	0.144	0.163
20	7.41	27.2	28.2	0.151	0.156
30	11.1	27.5	27.9	0.156	0.157
40	14.8	26.6	27.6	0.155	0.155
50	18.5	25.9	27.4	0.145	0.154
60	22.2	25.6	27.1	0.161	0.155
70	25.9	24.8	26.9	0.158	0.156
80	29.6	24.2	26.6	0.148	0.156
90	33.3	18.5	26	0.116	0.153

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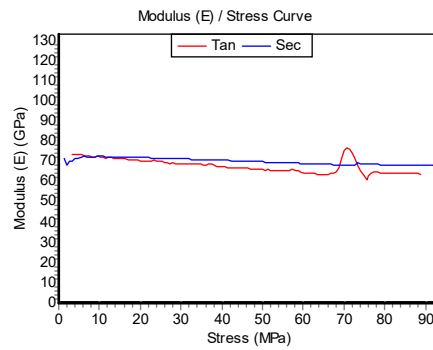
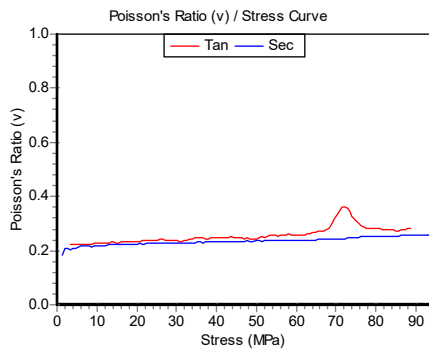
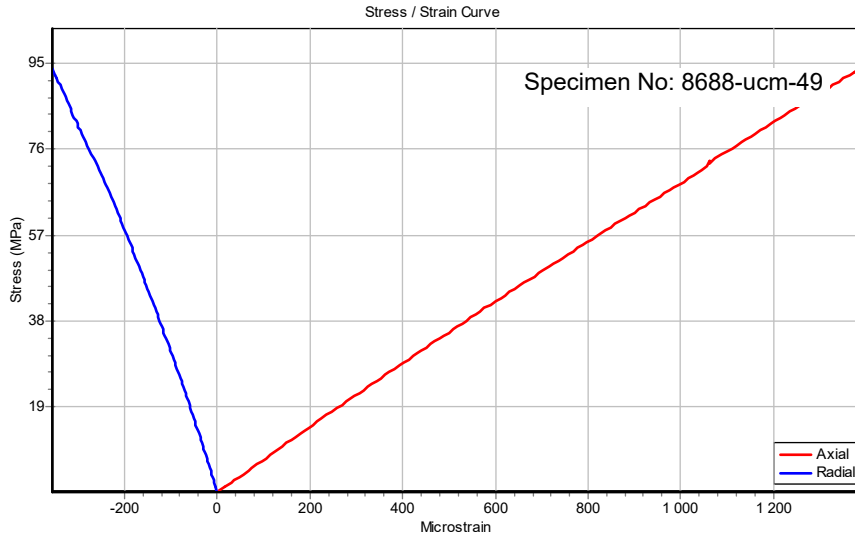
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:32:14

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 522.5 kN

Peak Strength: 93.78 MPa

Axial Strain at Failure: 1386 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	9.38	72.5	72.5	0.226	0.219
20	18.8	70.5	72	0.233	0.223
30	28.1	69	71.4	0.240	0.228
40	37.5	68.1	70.7	0.245	0.232
50	46.9	66.3	70	0.245	0.235
60	56.3	65.7	69.3	0.255	0.237
70	65.6	63.8	68.6	0.272	0.241
80	75	61.1	68.7	0.300	0.250
90	84.4	64.2	68.1	0.273	0.254

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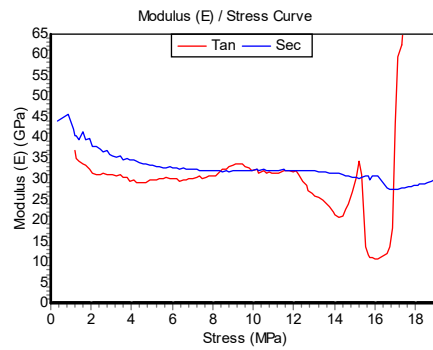
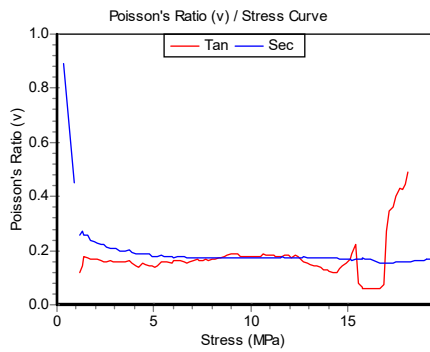
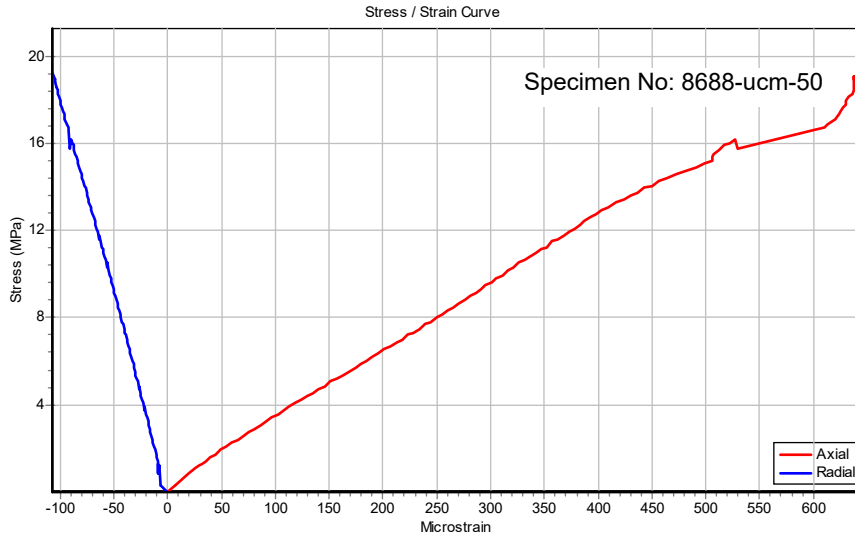
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:44:20

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 107.3 kN

Peak Strength: 19.26 MPa

Axial Strain at Failure: 643 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.93	32.4	39.8	0.167	0.234
20	3.85	29.5	34.6	0.151	0.191
30	5.78	30.1	33	0.153	0.176
40	7.7	30.7	32	0.163	0.173
50	9.63	32.6	32.1	0.176	0.173
60	11.6	32	32	0.177	0.176
70	13.5	24.3	31.6	0.140	0.173
80	15.4	13.7	30.6	0.078	0.170
90	17.3	70.9	27.9	0.400	0.156

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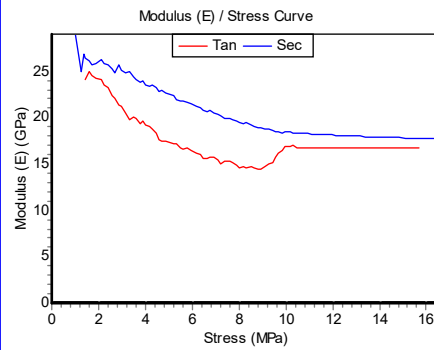
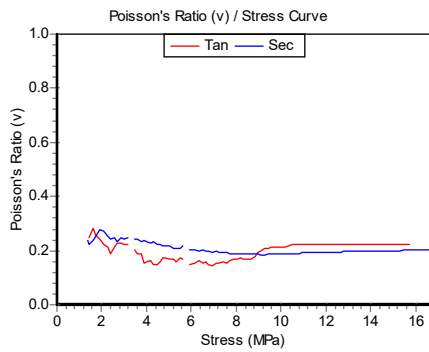
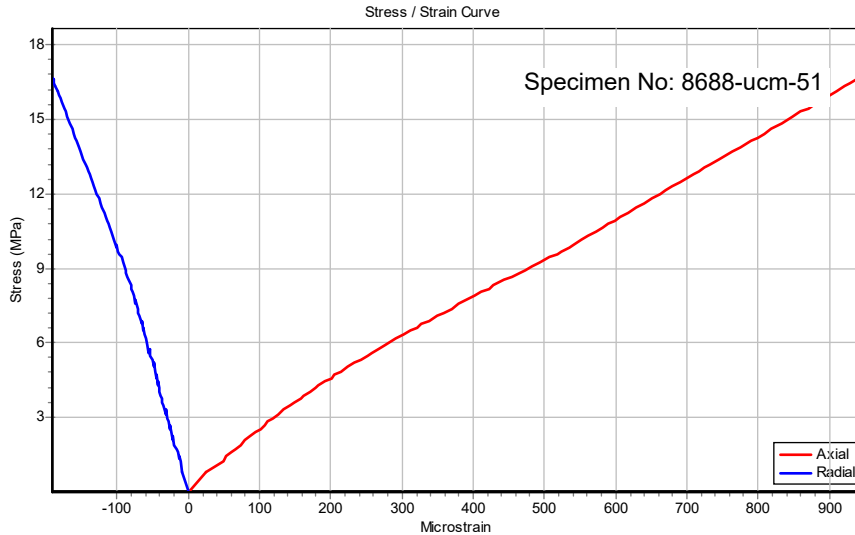
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:24:37

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 93.12 kN

Peak Strength: 16.66 MPa

Axial Strain at Failure: 942 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	1.67	24.6	25.7	0.258	0.253
20	3.33	20.1	24.3	0.205	0.245
30	5	17.4	22.6	0.168	0.216
40	6.66	15.7	20.7	0.149	0.199
50	8.33	14.7	19.2	0.169	0.188
60	10	16.9	18.4	0.211	0.188
70	11.7	16.7	18.1	0.223	0.193
80	13.3	16.7	17.9	0.222	0.197
90	15	16.7	17.8	0.223	0.200

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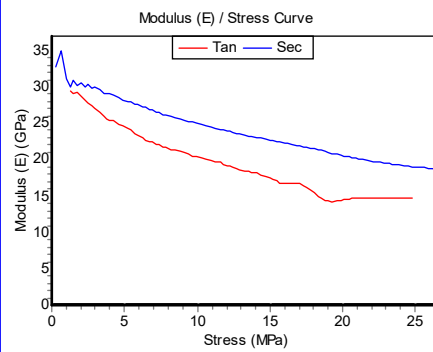
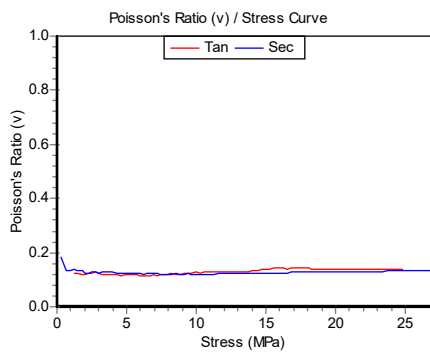
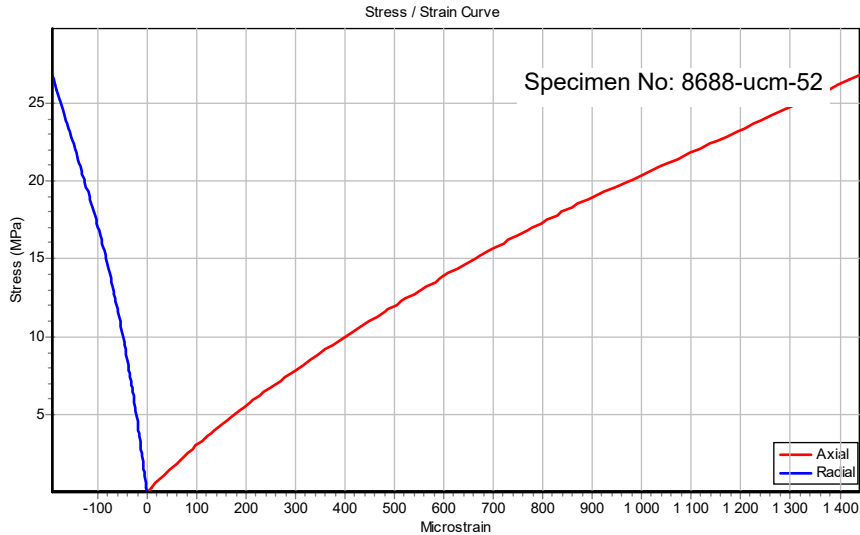
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:06:27

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 150.2 kN

Peak Strength: 26.81 MPa

Axial Strain at Failure: 1439 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.68	27.5	29.8	0.128	0.127
20	5.36	24.1	27.9	0.120	0.123
30	8.04	21.4	26	0.122	0.120
40	10.7	20	24.5	0.128	0.121
50	13.4	18.5	23.2	0.129	0.123
60	16.1	16.8	22.2	0.142	0.126
70	18.8	14.4	21.1	0.139	0.129
80	21.4	14.7	19.9	0.139	0.131
90	24.1	14.7	19.2	0.140	0.132

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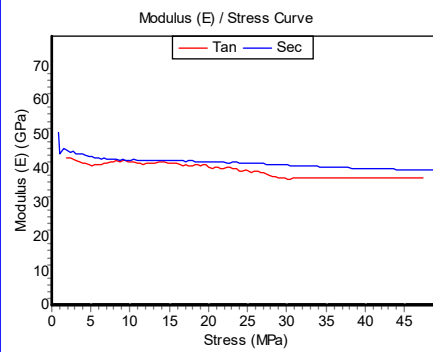
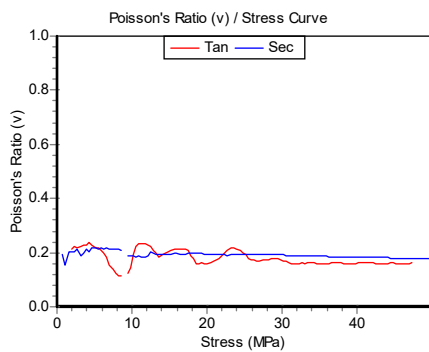
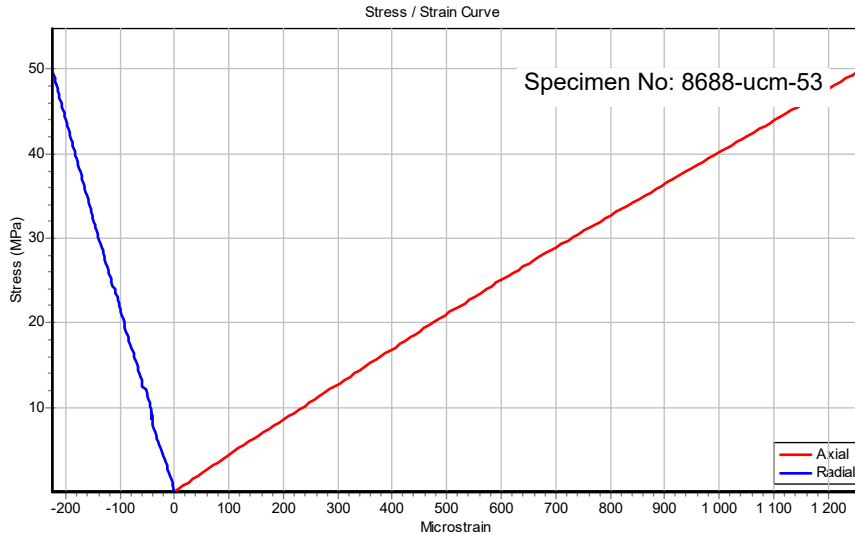
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:09:09

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 281.1 kN

Peak Strength: 49.77 MPa

Axial Strain at Failure: 1257 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.98	41	43.7	0.217	0.216
20	9.95	42.1	42.6	0.194	0.187
30	14.9	41.8	42.4	0.207	0.194
40	19.9	40.5	42.1	0.159	0.193
50	24.9	39.4	41.7	0.192	0.193
60	29.9	37.1	41.1	0.170	0.191
70	34.8	37.5	40.6	0.160	0.186
80	39.8	37.5	40.1	0.161	0.183
90	44.8	37.4	39.8	0.160	0.180

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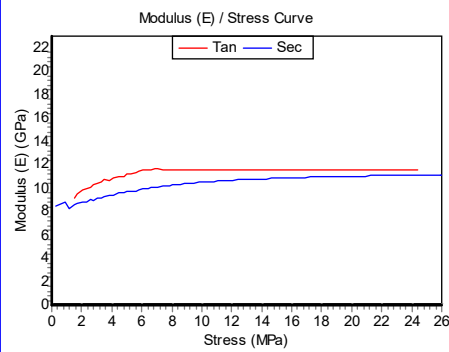
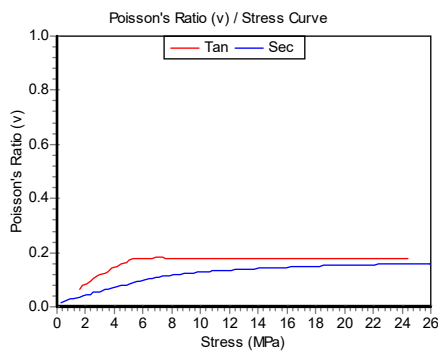
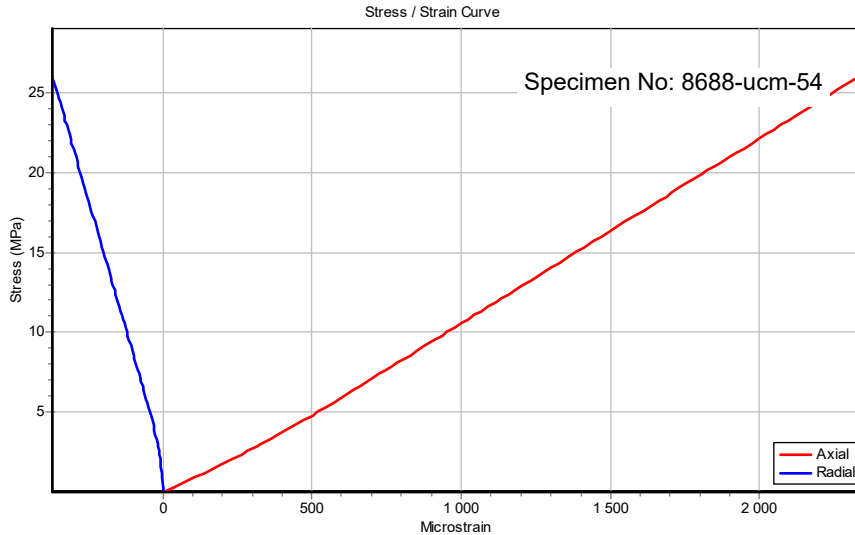
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:11:37

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 146.8 kN

Peak Strength: 26 MPa

Axial Strain at Failure: 2334 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.6	10.3	8.95	0.112	0.055
20	5.2	11.2	9.72	0.176	0.088
30	7.8	11.6	10.2	0.180	0.115
40	10.4	11.6	10.6	0.180	0.131
50	13	11.6	10.8	0.180	0.140
60	15.6	11.6	10.9	0.180	0.146
70	18.2	11.6	11	0.180	0.150
80	20.8	11.6	11	0.180	0.154
90	23.4	11.6	11.1	0.180	0.157

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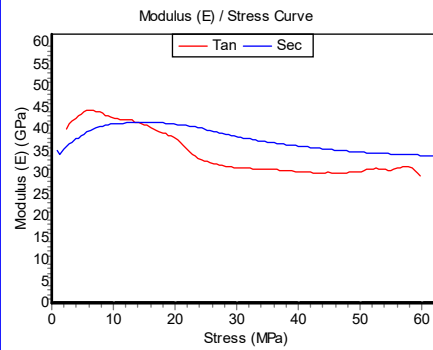
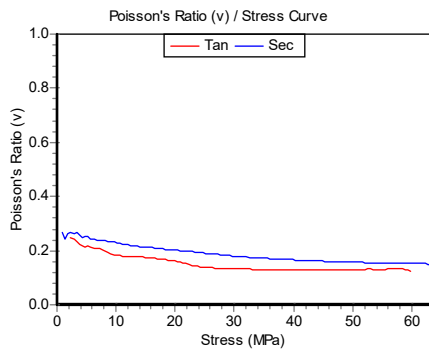
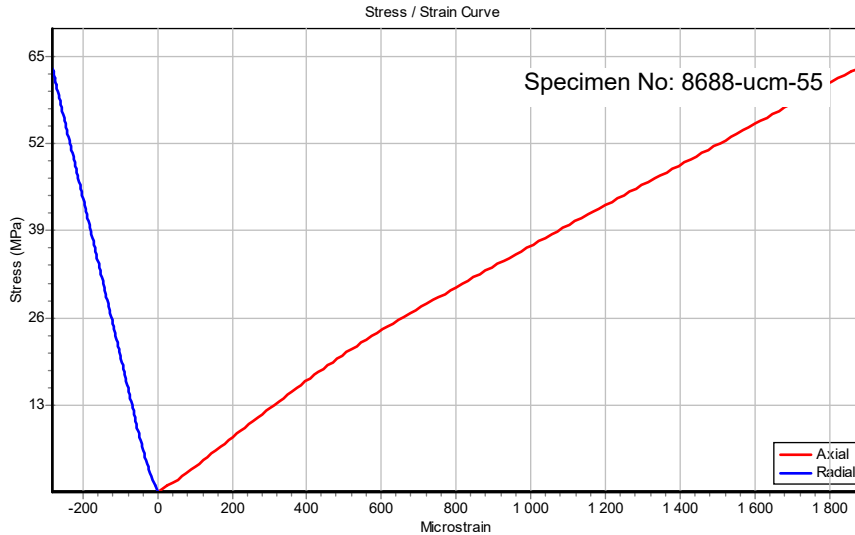
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UNIAXIAL COMPRESSION TEST

2021/10/05 09:40:36

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 357.4 kN

Peak Strength: 63.18 MPa

Axial Strain at Failure: 1879 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	6.32	44.4	40	0.208	0.238
20	12.6	42.1	41.5	0.179	0.218
30	19	38.5	41.4	0.164	0.204
40	25.3	32.4	39.8	0.137	0.189
50	31.6	31.1	37.8	0.132	0.176
60	37.9	30.5	36.5	0.129	0.168
70	44.2	30	35.5	0.127	0.161
80	50.5	30.5	34.7	0.130	0.156
90	56.9	31.3	34.2	0.133	0.153

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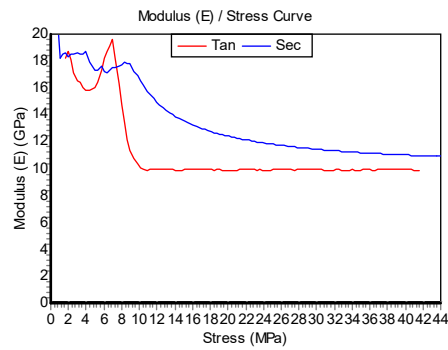
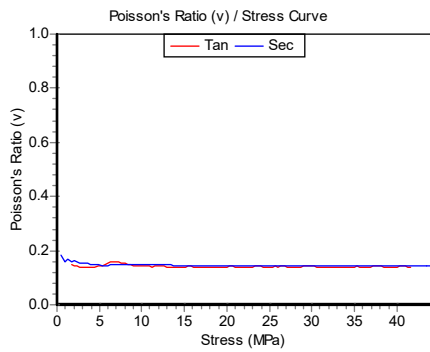
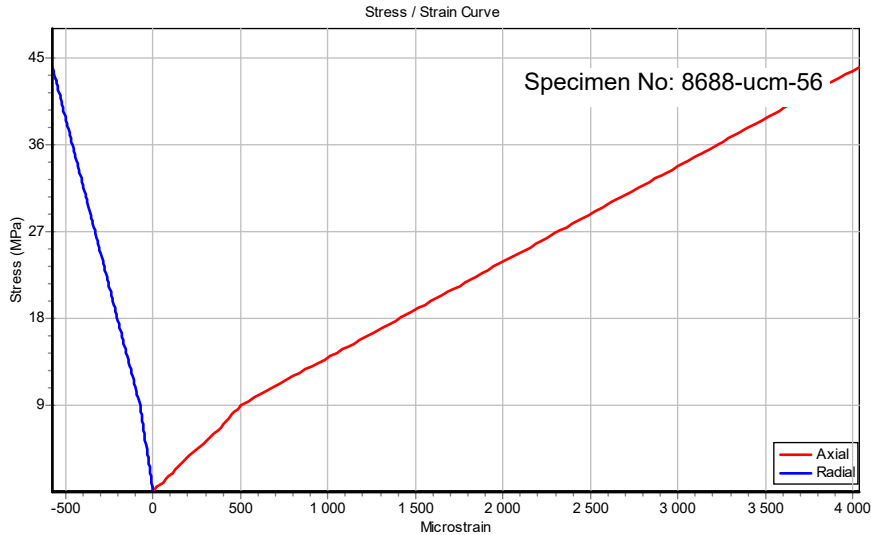
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:14:47

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 249 kN

Peak Strength: 44 MPa

Axial Strain at Failure: 4036 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	4.4	15.8	17.9	0.140	0.150
20	8.8	11.3	17.8	0.146	0.150
30	13.2	9.9	14.2	0.141	0.147
40	17.6	9.9	12.8	0.141	0.145
50	22	9.9	12.1	0.141	0.144
60	26.4	9.9	11.7	0.142	0.144
70	30.8	9.9	11.4	0.141	0.143
80	35.2	9.9	11.2	0.142	0.143
90	39.6	9.9	11	0.141	0.143

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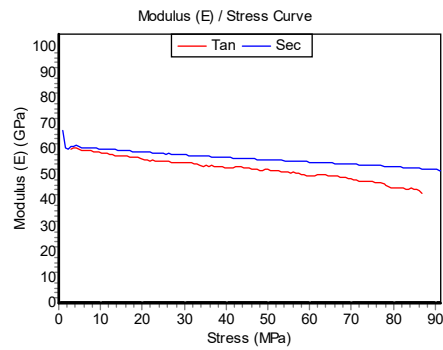
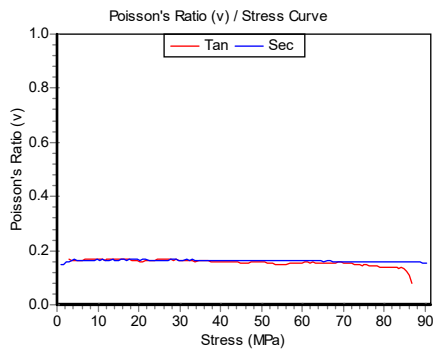
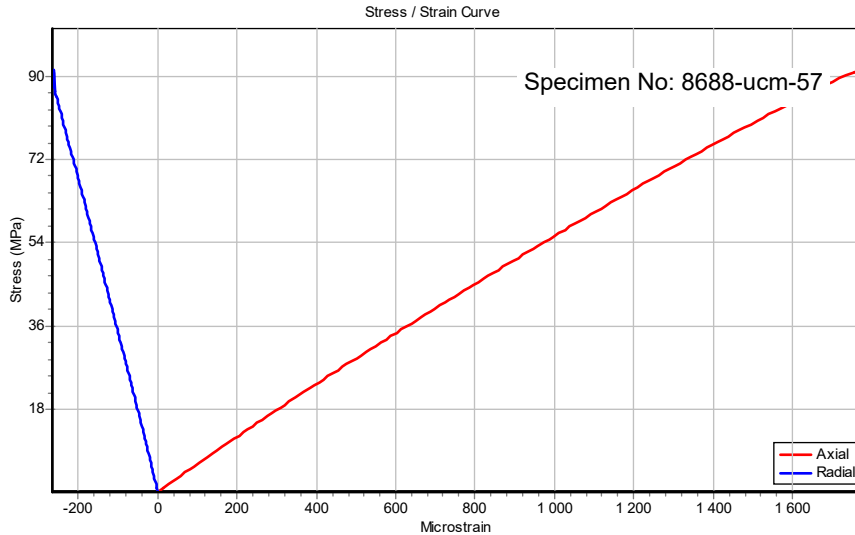
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UNIAXIAL COMPRESSION TEST

2021/09/29 12:33:39

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 516.7 kN

Peak Strength: 91.34 MPa

Axial Strain at Failure: 1768 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	9.13	58.8	60.3	0.169	0.167
20	18.3	56.9	59.2	0.165	0.167
30	27.4	55	58.1	0.167	0.166
40	36.5	53.5	57.1	0.161	0.165
50	45.7	52.4	56.3	0.154	0.163
60	54.8	50.9	55.4	0.150	0.162
70	63.9	49.9	54.7	0.154	0.161
80	73.1	47.5	53.9	0.149	0.160
90	82.2	44.8	53	0.137	0.158

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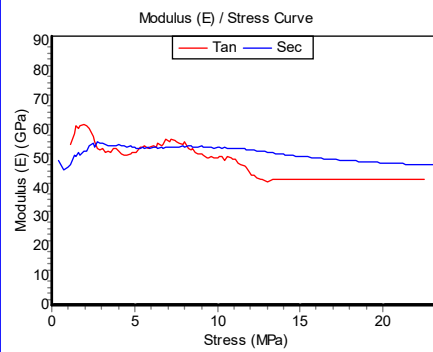
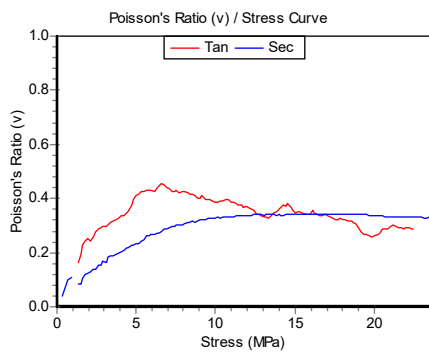
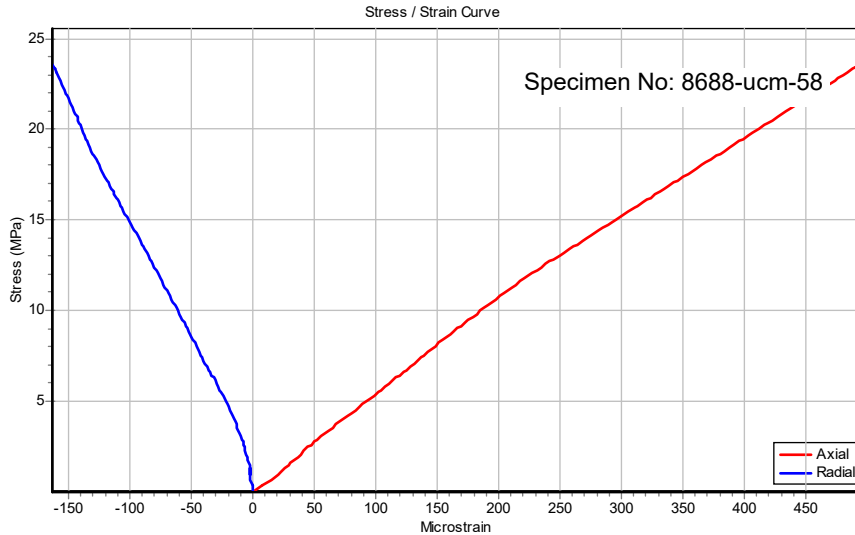
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UNIAXIAL COMPRESSION TEST

2021/09/29 13:23:19

WITH ELASTIC MODULUS AND POISSON'S RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Failure Load: 133.3 kN

Peak Strength: 23.56 MPa

Axial Strain at Failure: 493 microstrain

% Strength	Strength (MPa)	E Tan (GPa)	E Sec (GPa)	v Tan	v Sec
10	2.36	57.6	55.5	0.276	0.141
20	4.71	51.7	54.7	0.377	0.226
30	7.07	55.6	54.1	0.435	0.292
40	9.42	50.6	54.2	0.397	0.325
50	11.8	46	53.2	0.373	0.337
60	14.1	43.1	51.3	0.374	0.339
70	16.5	43.1	50	0.339	0.342
80	18.8	43.1	49	0.292	0.341
90	21.2	43.1	48.3	0.298	0.333

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APPENDIX 2

CLASSIFICATION OF ROCK SPECIMEN FAILURE MODE INFLUENCED / NOT INFLUENCED BY DISCONTINUITIES DURING COMPRESSION TESTING

FAILURE NOT INFLUENCED BY DISCONTINUITIES (INTACT)

TYPE CODE	DESCRIPTION OF SUB CODES	
	A	B
X	SINGLE SLIDING SHEAR FAILURE	COMPLETE CONE DEVELOPMENT
Y	SPLITTING	

FAILURE INFLUENCED BY DISCONTINUITIES

TYPE CODE	DESCRIPTION OF SUB CODES	
	A	B
	PARTIAL FAILURE ON DISCONTINUITY	FAILURE COMPLETELY ON DISCONTINUITY
1	AT 0-10° TO AXIS	AT 0-10° TO AXIS
2	AT 11-20° TO AXIS	AT 11-20° TO AXIS
3	AT 21-30° TO AXIS	AT 21-30° TO AXIS
4	AT 31-40° TO AXIS	AT 31-40° TO AXIS
5	AT 41-50° TO AXIS	AT 41-50° TO AXIS
6	AT 51-70° TO AXIS	AT 51-70° TO AXIS
7	AT 71-90° TO AXIS	AT 71-90° TO AXIS
0	Multiple Discontinuities	Multiple Discontinuities

Example: Failure Type3B: Failure completely on a discontinuity with an orientation of between 21° and 30° to the specimen axis.

