Solutions Manual for Steel Design 7th Edition by Segui, Soleimani

ISBN: 9798214012223

STEEL DESIGN [7TH EDITION]

William T. Segui and Sayed M. Soleimani

CHAPTER 1 – INTRODUCTION

1.5-1

(a) $A = \pi(0.550)^2/4 = 0.2376$ in.^{2}

$$F_u = \frac{P_u}{A} = \frac{28{,}500}{0.2376} = 120{,}000 \text{ psi} = 120 \text{ ksi}$$

F_u = 120 ksi (827.4 MPa)

(b) $e = \frac{2.300-2.030}{2.030} \times 100 = 13.3\%$

e = 13.3%

(c) $A_f = \pi(0.430)^2/4 = 0.1452$ in.^{2}

Change $= \frac{A_f - A_o}{A_o} \times 100 = \frac{0.1452-0.2376}{0.2376} \times 100 = -38.9\%$

Reduction = 38.9%

1.5-2

$A = \pi(0.5)^2/4 = 0.1963$ in.^{2}

$$f = \frac{P}{A} = \frac{13.5}{0.1963} = 68.77 \text{ ksi}$$

$$\varepsilon = \frac{\Delta L}{L} = \frac{4.66 \times 10^{-3}}{2} = 2.33 \times 10^{-3}$$

$$E = \frac{f}{\varepsilon} = \frac{68.77}{2.33 \times 10^{-3}} = 29{,}500 \text{ ksi}$$

E = 29,500 ksi (203.4 GPa)

1.5-3

$A = \pi(0.510)^2/4 = 0.2043$ in.^{2}

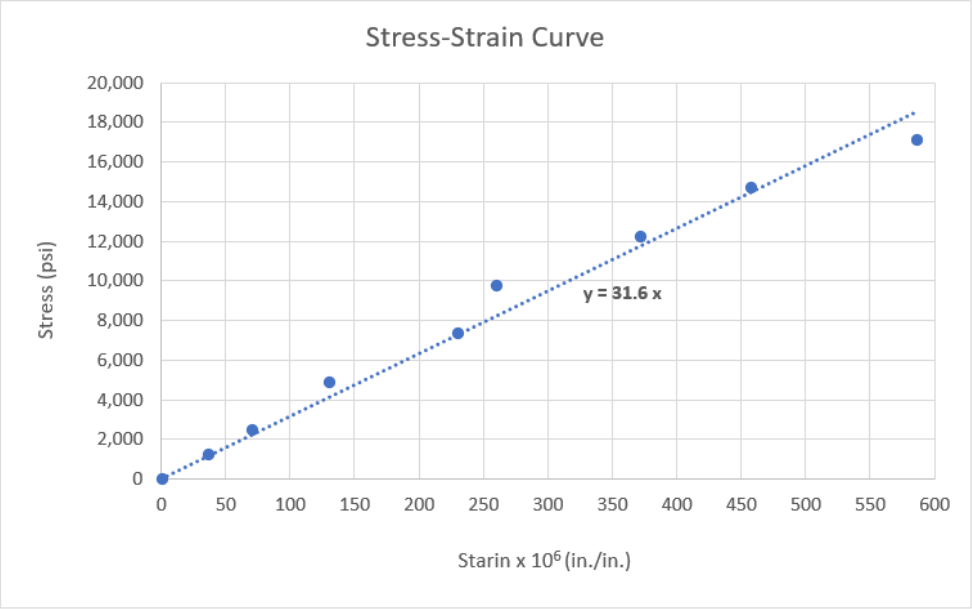
For $P = 250$ lb, $f = \frac{P}{A} = \frac{250}{0.2043} = 1224$ psi

Spreadsheet results:

(a)

Load (lb)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0
250	37.1	1,224
500	70.3	2,448
1,000	129.1	4,895
1,500	230.1	7,343
2,000	259.4	9,790
2,500	372.4	12,238
3,000	457.7	14,686
3,500	586.5	17,133

(b)



(c)

E = slope = 31,600 ksi (217.9 GPa)

1.5-4

$A = \pi(0.5)^2/4 = 0.1963 \text{ in.}^2$

$$E = \frac{f}{\varepsilon} = \frac{P/A}{\Delta L/L} = \frac{P}{\Delta L} \cdot \frac{L}{A} = 1{,}392(4/0.1963) = 28{,}400 \text{ ksi}$$

E = 28,400 ksi (195.8 GPa)

1.5-5

$A = \pi(3/8)^2/4 = 0.1104 \text{ in.}^2$

For $P = 550$ lb, $f = \frac{P}{A} = \frac{550}{0.1104} = 4{,}982$ psi

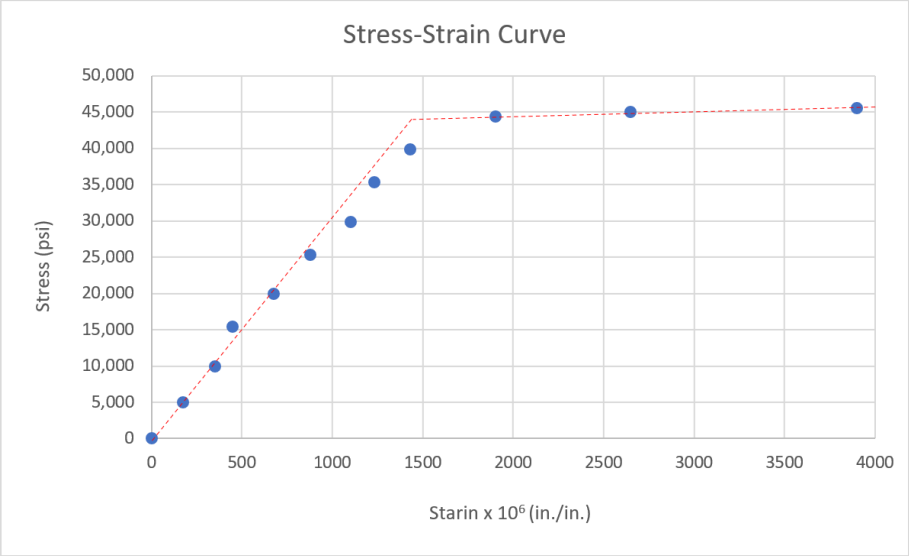
$$\varepsilon = \frac{\Delta L}{L} = \frac{350 \times 10^{-6}}{2} = 175 \times 10^{-6}$$

Spreadsheet results:

(a)

Load (lb)	Elongation x 10^6 (in.)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0	0
550	350	175	4,982
1,100	700	350	9,964
1,700	900	450	15,399
2,200	1,350	675	19,928
2,800	1,760	880	25,362
3,300	2,200	1,100	29,891
3,900	2,460	1,230	35,326
4,400	2,860	1,430	39,855
4,900	3,800	1,900	44,384
4,970	5,300	2,650	45,018
5,025	7,800	3,900	45,516

(b)



(c) $E = \text{slope} = \frac{15{,}000}{500\times10^{-6}} = 30{,}000{,}000 \text{ psi} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_y \approx 44{,}000$ psi ≈ 44 ksi (≈ 303 MPa)

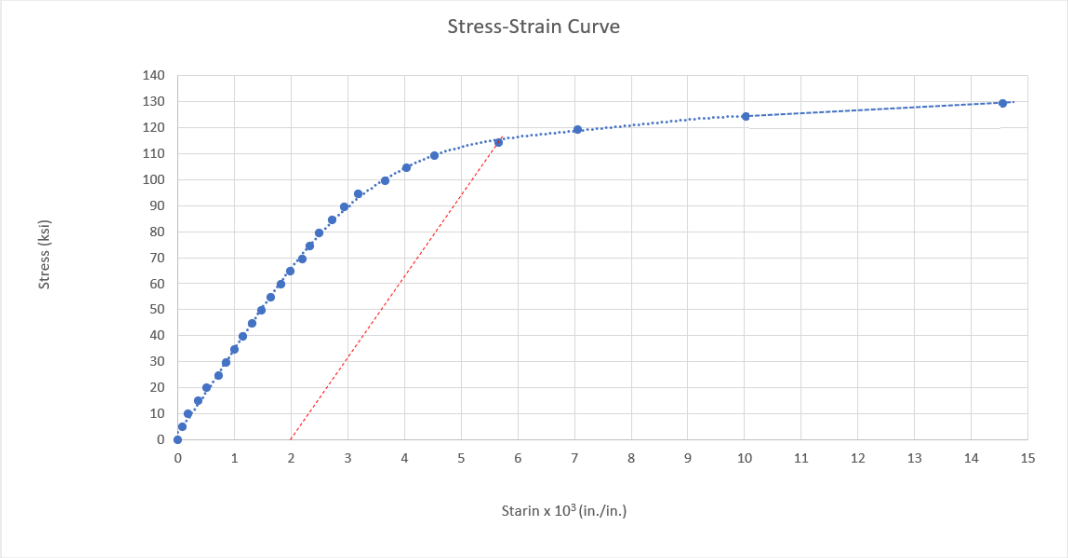
1.5-6

Spreadsheet results:

(a)

Load (kips)	Elongation x 10^3 (in.)	Starin x 10^3 (in./in.)	Stress (ksi)
0	0.000	0.000	0.000
1	0.160	0.080	4.973
2	0.352	0.176	9.945
3	0.706	0.353	14.918
4	1.012	0.506	19.891
5	1.434	0.717	24.863
6	1.712	0.856	29.836
7	1.986	0.993	34.809
8	2.286	1.143	39.781
9	2.612	1.306	44.754
10	2.938	1.469	49.727
11	3.274	1.637	54.699
12	3.632	1.816	59.672
13	3.976	1.988	64.644
14	4.386	2.193	69.617
15	4.640	2.320	74.590
16	4.988	2.494	79.562
17	5.432	2.716	84.535
18	5.862	2.931	89.508
19	6.362	3.181	94.480
20	7.304	3.652	99.453
21	8.072	4.036	104.426
22	9.044	4.522	109.398
23	11.310	5.655	114.371
24	14.120	7.060	119.344
25	20.044	10.022	124.316
26	29.106	14.553	129.289

(b)



(c) $E = \text{slope} = \frac{80-50}{0.0025-0.0015} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_{pl} \approx$ 85 ksi (≈ 586 MPa)

$F_y \approx$ 116 ksi (≈ 800 MPa)

STEEL DESIGN [7TH EDITION]

William T. Segui and Sayed M. Soleimani

CHAPTER 1 – INTRODUCTION

1.5-1

(a) $A = \pi(0.550)^2/4 = 0.2376$ in.^{2}

$$F_u = \frac{P_u}{A} = \frac{28{,}500}{0.2376} = 120{,}000 \text{ psi} = 120 \text{ ksi}$$

F_u = 120 ksi (827.4 MPa)

(b) $e = \frac{2.300-2.030}{2.030} \times 100 = 13.3\%$

e = 13.3%

(c) $A_f = \pi(0.430)^2/4 = 0.1452$ in.^{2}

Change $= \frac{A_f - A_o}{A_o} \times 100 = \frac{0.1452-0.2376}{0.2376} \times 100 = -38.9\%$

Reduction = 38.9%

1.5-2

$A = \pi(0.5)^2/4 = 0.1963$ in.^{2}

$$f = \frac{P}{A} = \frac{13.5}{0.1963} = 68.77 \text{ ksi}$$

$$\varepsilon = \frac{\Delta L}{L} = \frac{4.66 \times 10^{-3}}{2} = 2.33 \times 10^{-3}$$

$$E = \frac{f}{\varepsilon} = \frac{68.77}{2.33 \times 10^{-3}} = 29{,}500 \text{ ksi}$$

E = 29,500 ksi (203.4 GPa)

1.5-3

$A = \pi(0.510)^2/4 = 0.2043$ in.^{2}

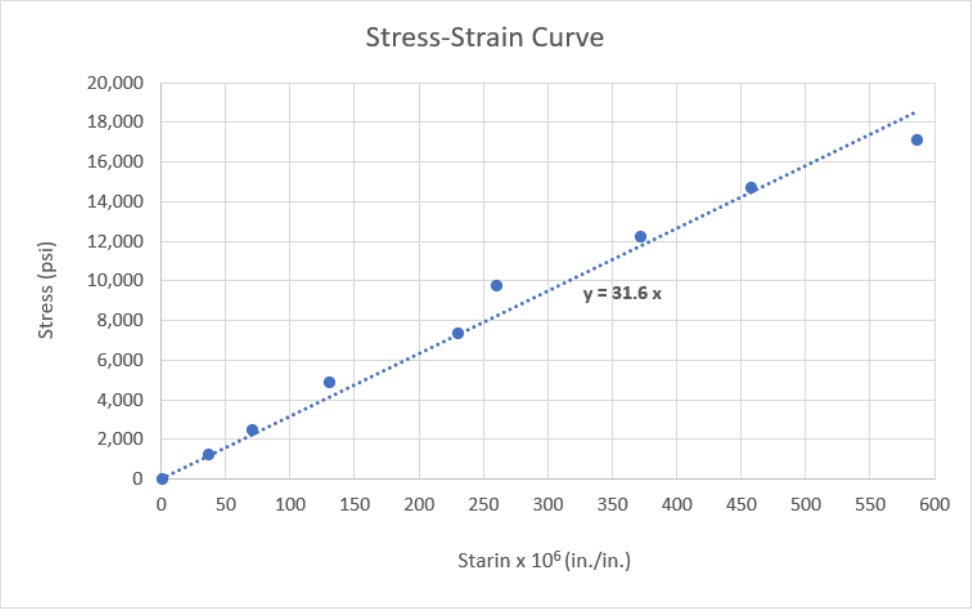
For $P = 250$ lb, $f = \frac{P}{A} = \frac{250}{0.2043} = 1224$ psi

Spreadsheet results:

(a)

Load (lb)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0
250	37.1	1,224
500	70.3	2,448
1,000	129.1	4,895
1,500	230.1	7,343
2,000	259.4	9,790
2,500	372.4	12,238
3,000	457.7	14,686
3,500	586.5	17,133

(b)



(c)

E = slope = 31,600 ksi (217.9 GPa)

1.5-4

$A = \pi(0.5)^2/4 = 0.1963 \text{ in.}^2$

$$E = \frac{f}{\varepsilon} = \frac{P/A}{\Delta L/L} = \frac{P}{\Delta L} \cdot \frac{L}{A} = 1{,}392(4/0.1963) = 28{,}400 \text{ ksi}$$

E = 28,400 ksi (195.8 GPa)

1.5-5

$A = \pi(3/8)^2/4 = 0.1104 \text{ in.}^2$

For $P = 550$ lb, $f = \frac{P}{A} = \frac{550}{0.1104} = 4{,}982$ psi

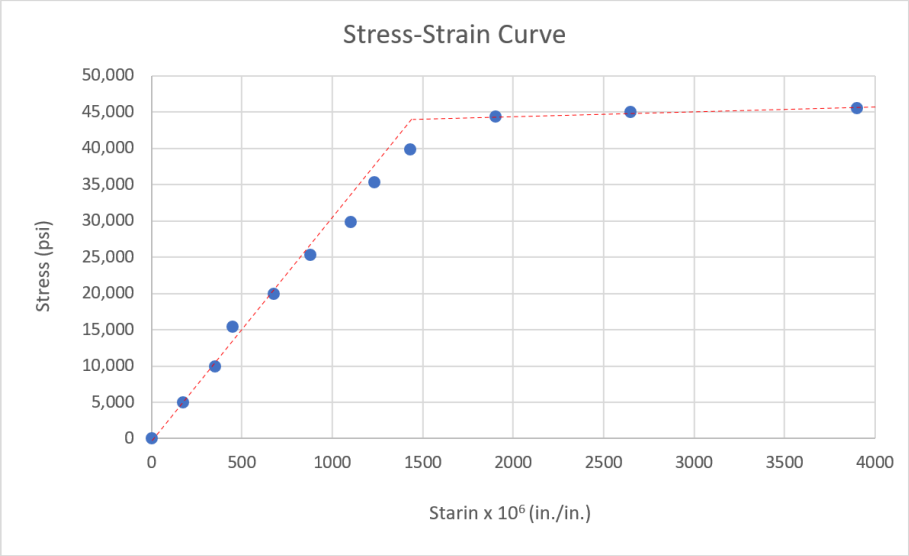
$$\varepsilon = \frac{\Delta L}{L} = \frac{350 \times 10^{-6}}{2} = 175 \times 10^{-6}$$

Spreadsheet results:

(a)

Load (lb)	Elongation x 10^6 (in.)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0	0
550	350	175	4,982
1,100	700	350	9,964
1,700	900	450	15,399
2,200	1,350	675	19,928
2,800	1,760	880	25,362
3,300	2,200	1,100	29,891
3,900	2,460	1,230	35,326
4,400	2,860	1,430	39,855
4,900	3,800	1,900	44,384
4,970	5,300	2,650	45,018
5,025	7,800	3,900	45,516

(b)



(c) $E = \text{slope} = \frac{15{,}000}{500\times10^{-6}} = 30{,}000{,}000 \text{ psi} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_y \approx 44{,}000$ psi ≈ 44 ksi (≈ 303 MPa)

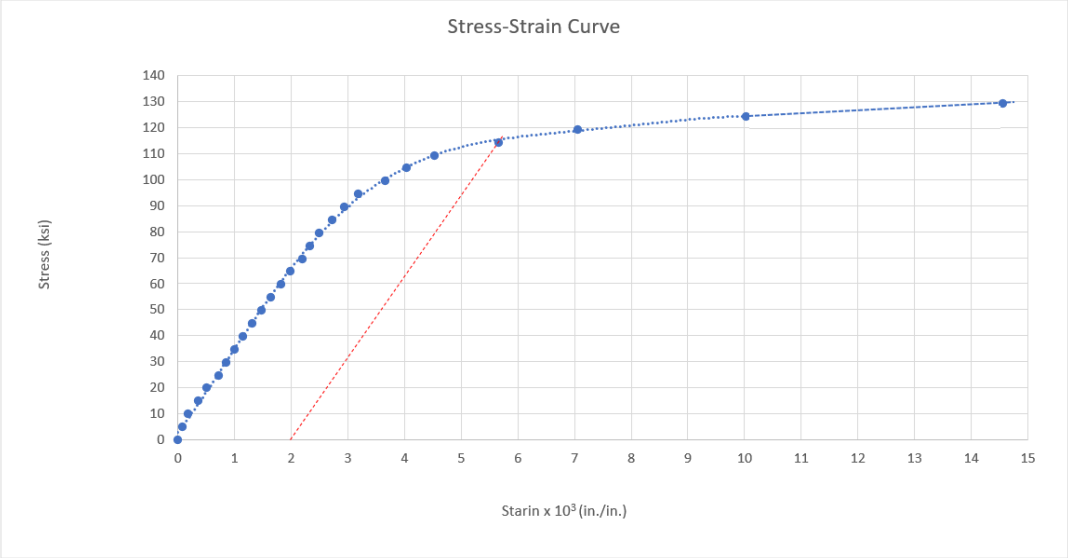
1.5-6

Spreadsheet results:

(a)

Load (kips)	Elongation x 10^3 (in.)	Starin x 10^3 (in./in.)	Stress (ksi)
0	0.000	0.000	0.000
1	0.160	0.080	4.973
2	0.352	0.176	9.945
3	0.706	0.353	14.918
4	1.012	0.506	19.891
5	1.434	0.717	24.863
6	1.712	0.856	29.836
7	1.986	0.993	34.809
8	2.286	1.143	39.781
9	2.612	1.306	44.754
10	2.938	1.469	49.727
11	3.274	1.637	54.699
12	3.632	1.816	59.672
13	3.976	1.988	64.644
14	4.386	2.193	69.617
15	4.640	2.320	74.590
16	4.988	2.494	79.562
17	5.432	2.716	84.535
18	5.862	2.931	89.508
19	6.362	3.181	94.480
20	7.304	3.652	99.453
21	8.072	4.036	104.426
22	9.044	4.522	109.398
23	11.310	5.655	114.371
24	14.120	7.060	119.344
25	20.044	10.022	124.316
26	29.106	14.553	129.289

(b)



(c) $E = \text{slope} = \frac{80-50}{0.0025-0.0015} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_{pl} \approx$ 85 ksi (≈ 586 MPa)

$F_y \approx$ 116 ksi (≈ 800 MPa)

STEEL DESIGN [7TH EDITION]

William T. Segui and Sayed M. Soleimani

CHAPTER 1 – INTRODUCTION

1.5-1

(a) $A = \pi(0.550)^2/4 = 0.2376$ in.^{2}

$$F_u = \frac{P_u}{A} = \frac{28{,}500}{0.2376} = 120{,}000 \text{ psi} = 120 \text{ ksi}$$

F_u = 120 ksi (827.4 MPa)

(b) $e = \frac{2.300-2.030}{2.030} \times 100 = 13.3\%$

e = 13.3%

(c) $A_f = \pi(0.430)^2/4 = 0.1452$ in.^{2}

Change $= \frac{A_f - A_o}{A_o} \times 100 = \frac{0.1452-0.2376}{0.2376} \times 100 = -38.9\%$

Reduction = 38.9%

1.5-2

$A = \pi(0.5)^2/4 = 0.1963$ in.^{2}

$$f = \frac{P}{A} = \frac{13.5}{0.1963} = 68.77 \text{ ksi}$$

$$\varepsilon = \frac{\Delta L}{L} = \frac{4.66 \times 10^{-3}}{2} = 2.33 \times 10^{-3}$$

$$E = \frac{f}{\varepsilon} = \frac{68.77}{2.33 \times 10^{-3}} = 29{,}500 \text{ ksi}$$

E = 29,500 ksi (203.4 GPa)

1.5-3

$A = \pi(0.510)^2/4 = 0.2043$ in.^{2}

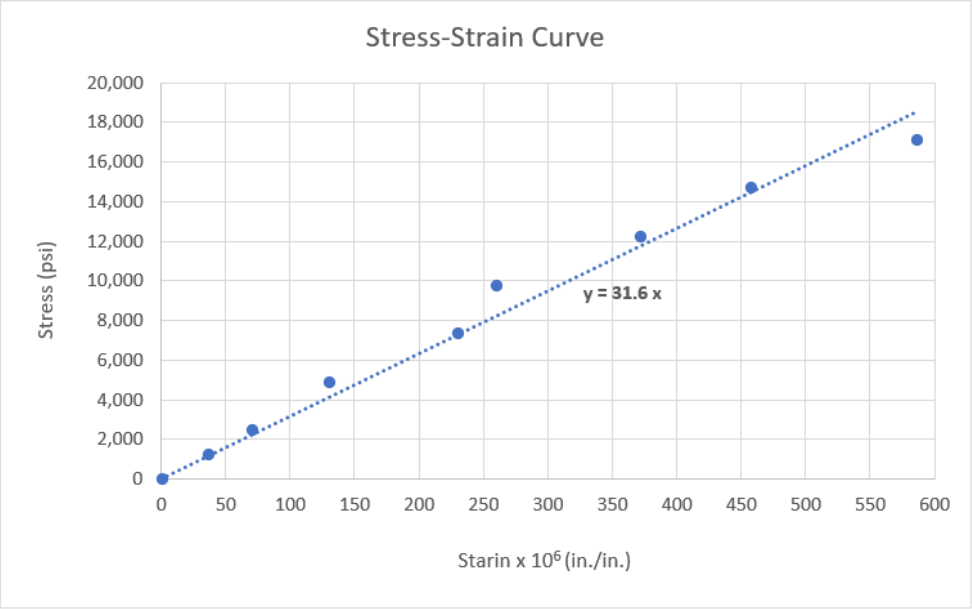
For $P = 250$ lb, $f = \frac{P}{A} = \frac{250}{0.2043} = 1224$ psi

Spreadsheet results:

(a)

Load (lb)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0
250	37.1	1,224
500	70.3	2,448
1,000	129.1	4,895
1,500	230.1	7,343
2,000	259.4	9,790
2,500	372.4	12,238
3,000	457.7	14,686
3,500	586.5	17,133

(b)



(c)

E = slope = 31,600 ksi (217.9 GPa)

1.5-4

$A = \pi(0.5)^2/4 = 0.1963 \text{ in.}^2$

$$E = \frac{f}{\varepsilon} = \frac{P/A}{\Delta L/L} = \frac{P}{\Delta L} \cdot \frac{L}{A} = 1{,}392(4/0.1963) = 28{,}400 \text{ ksi}$$

E = 28,400 ksi (195.8 GPa)

1.5-5

$A = \pi(3/8)^2/4 = 0.1104 \text{ in.}^2$

For $P = 550$ lb, $f = \frac{P}{A} = \frac{550}{0.1104} = 4{,}982$ psi

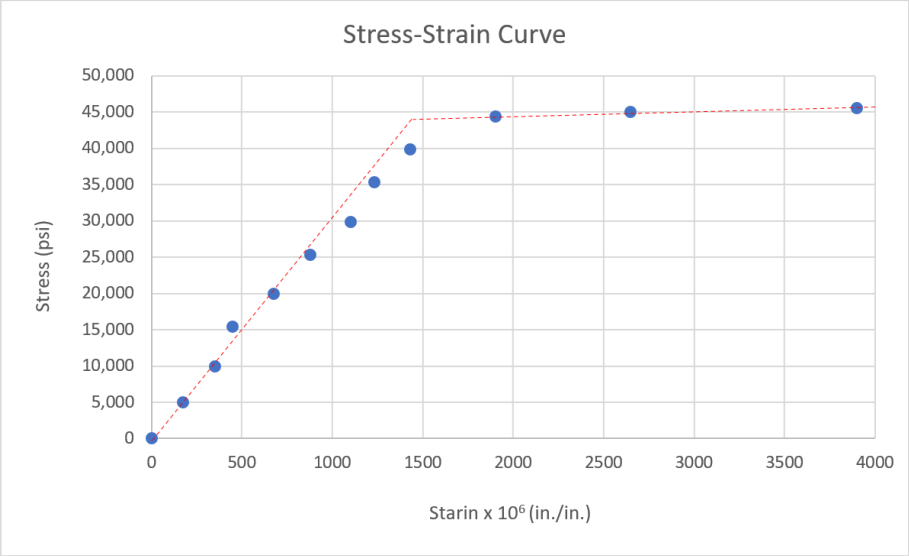
$$\varepsilon = \frac{\Delta L}{L} = \frac{350 \times 10^{-6}}{2} = 175 \times 10^{-6}$$

Spreadsheet results:

(a)

Load (lb)	Elongation x 10^6 (in.)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0	0
550	350	175	4,982
1,100	700	350	9,964
1,700	900	450	15,399
2,200	1,350	675	19,928
2,800	1,760	880	25,362
3,300	2,200	1,100	29,891
3,900	2,460	1,230	35,326
4,400	2,860	1,430	39,855
4,900	3,800	1,900	44,384
4,970	5,300	2,650	45,018
5,025	7,800	3,900	45,516

(b)



(c) $E = \text{slope} = \frac{15{,}000}{500\times10^{-6}} = 30{,}000{,}000 \text{ psi} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_y \approx 44{,}000$ psi ≈ 44 ksi (≈ 303 MPa)

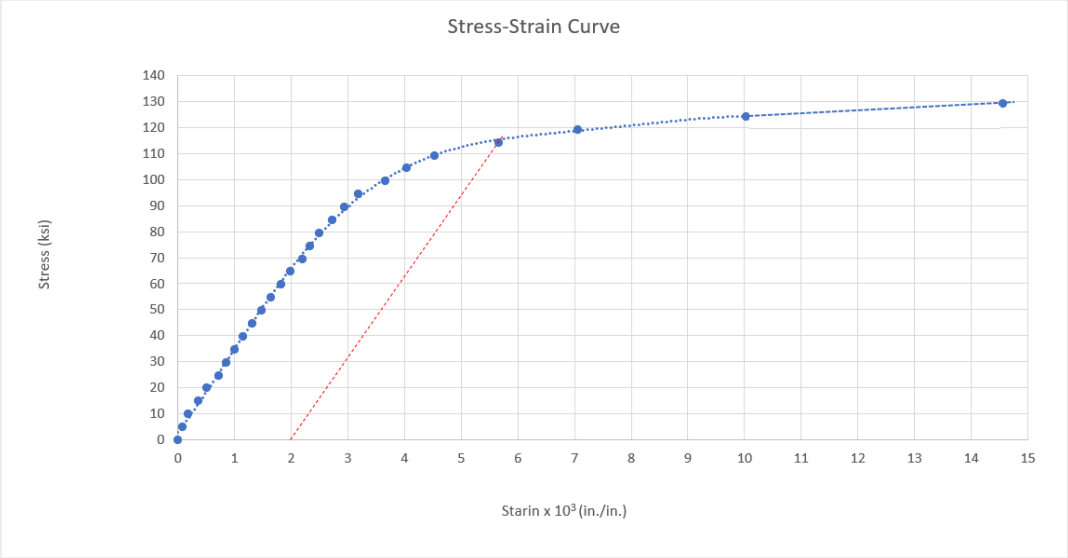
1.5-6

Spreadsheet results:

(a)

Load (kips)	Elongation x 10^3 (in.)	Starin x 10^3 (in./in.)	Stress (ksi)
0	0.000	0.000	0.000
1	0.160	0.080	4.973
2	0.352	0.176	9.945
3	0.706	0.353	14.918
4	1.012	0.506	19.891
5	1.434	0.717	24.863
6	1.712	0.856	29.836
7	1.986	0.993	34.809
8	2.286	1.143	39.781
9	2.612	1.306	44.754
10	2.938	1.469	49.727
11	3.274	1.637	54.699
12	3.632	1.816	59.672
13	3.976	1.988	64.644
14	4.386	2.193	69.617
15	4.640	2.320	74.590
16	4.988	2.494	79.562
17	5.432	2.716	84.535
18	5.862	2.931	89.508
19	6.362	3.181	94.480
20	7.304	3.652	99.453
21	8.072	4.036	104.426
22	9.044	4.522	109.398
23	11.310	5.655	114.371
24	14.120	7.060	119.344
25	20.044	10.022	124.316
26	29.106	14.553	129.289

(b)



(c) $E = \text{slope} = \frac{80-50}{0.0025-0.0015} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

$F_{pl} \approx$ 85 ksi (≈ 586 MPa)

$F_y \approx$ 116 ksi (≈ 800 MPa)