Steel Design 7th edition Segui Solutions Manual

SKU: 9798214012223-SOLUTIONS

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}

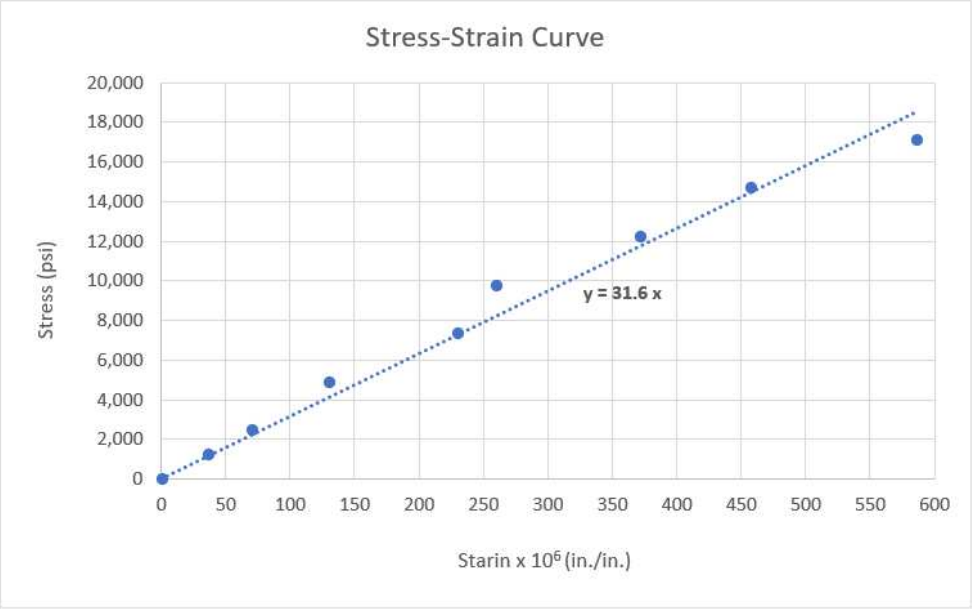
For $P = 250$ lb, $f = \frac{P}{A} = \frac{250}{0.2043} = 1224$ psi

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)

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

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

E = 28,400 ksi (195.8 GPa)

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

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

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Load (lb)	Elongation x 10^6 (in.)	Starin x 10^6 (in./in.)	Stress (psi)
0	0	0	0
550	350	175	4,982
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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
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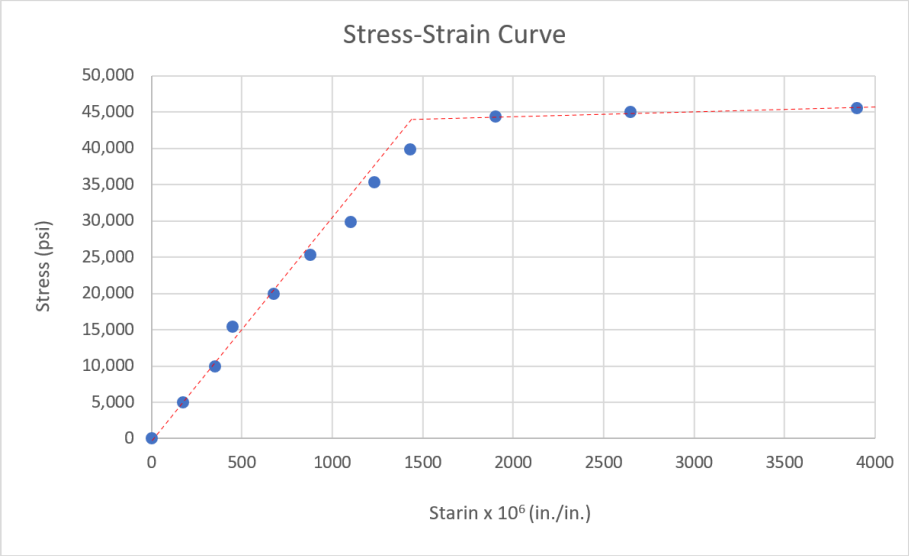

(c) $E = \text{slope} = \frac{15{,}000}{500\times10^{-6}} = 30{,}000{,}000 \text{ psi} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

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

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Spreadsheet results:

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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
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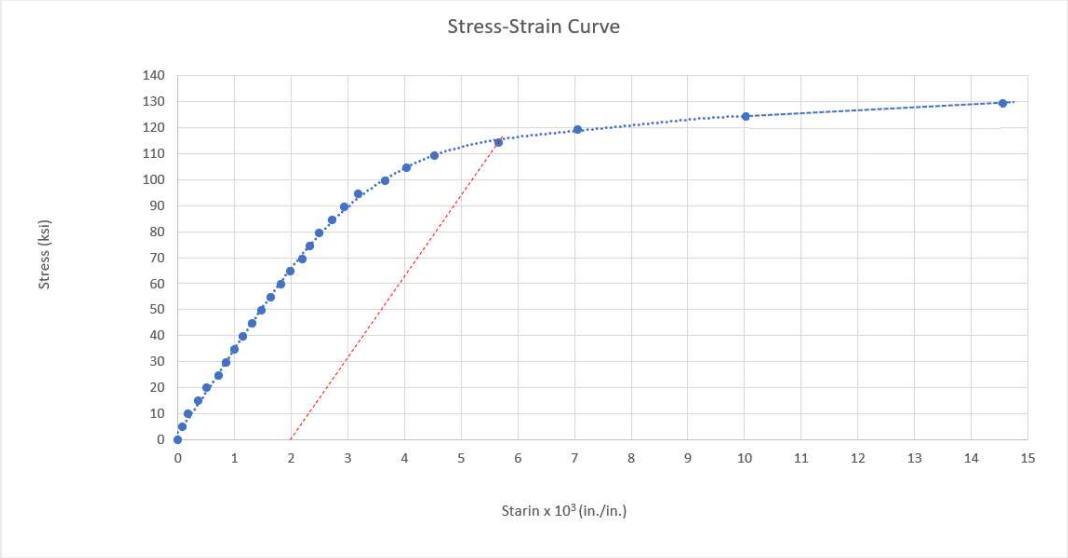

(c) $E = \text{slope} = \frac{80-50}{0.0025-0.0015} = 30{,}000 \text{ ksi}$

E = 30,000 ksi (206.8 GPa)

(d)

F_{pl} ≈ 85 ksi (≈ 586 MPa)

F_y ≈ 116 ksi (≈ 800 MPa)

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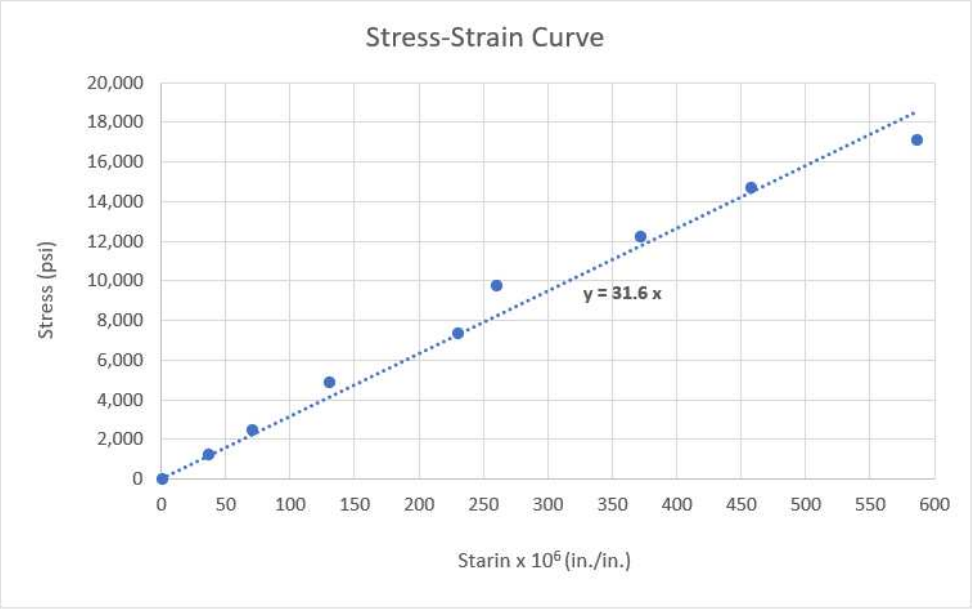

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For $P = 550$ lb, $f = \frac{P}{A} = \frac{550}{0.1104} = 4{,}982$ psi

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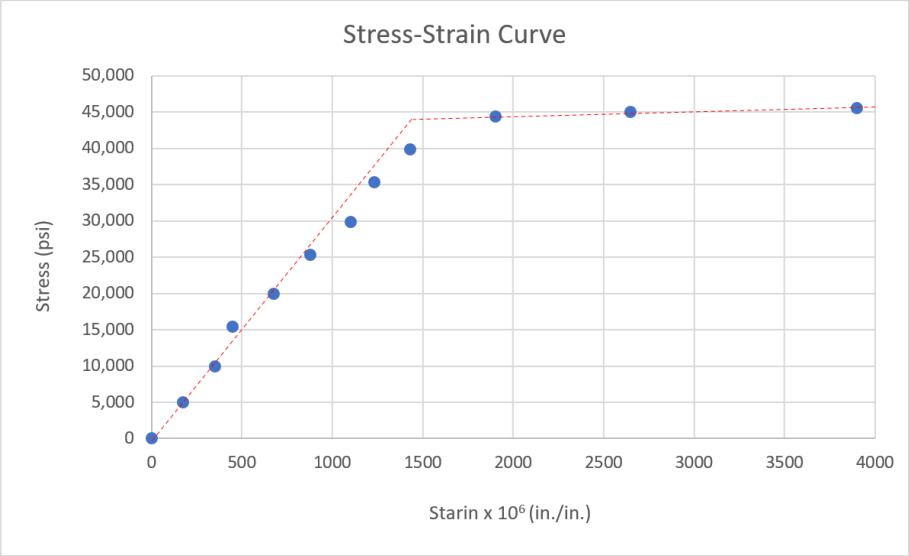

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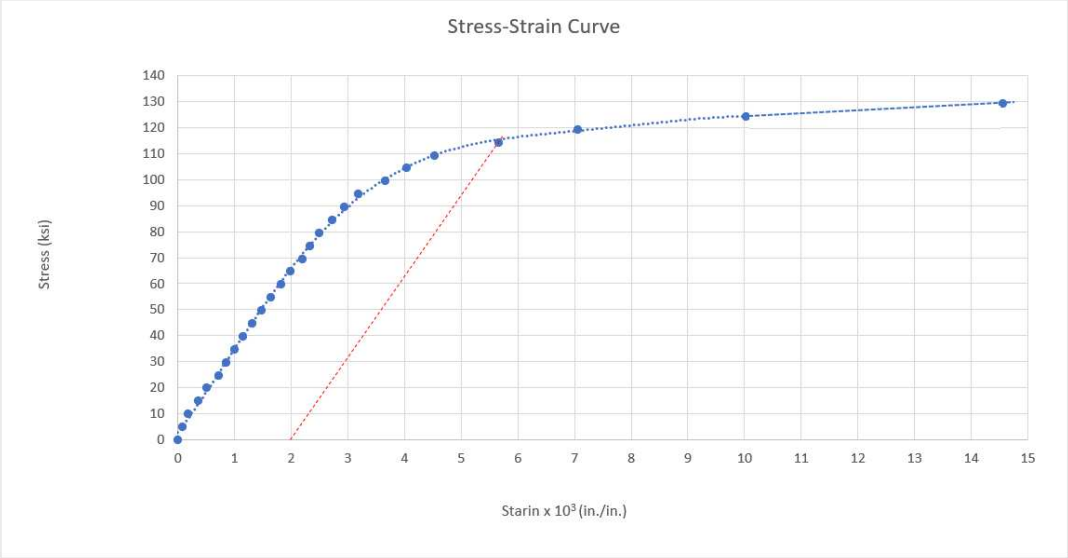

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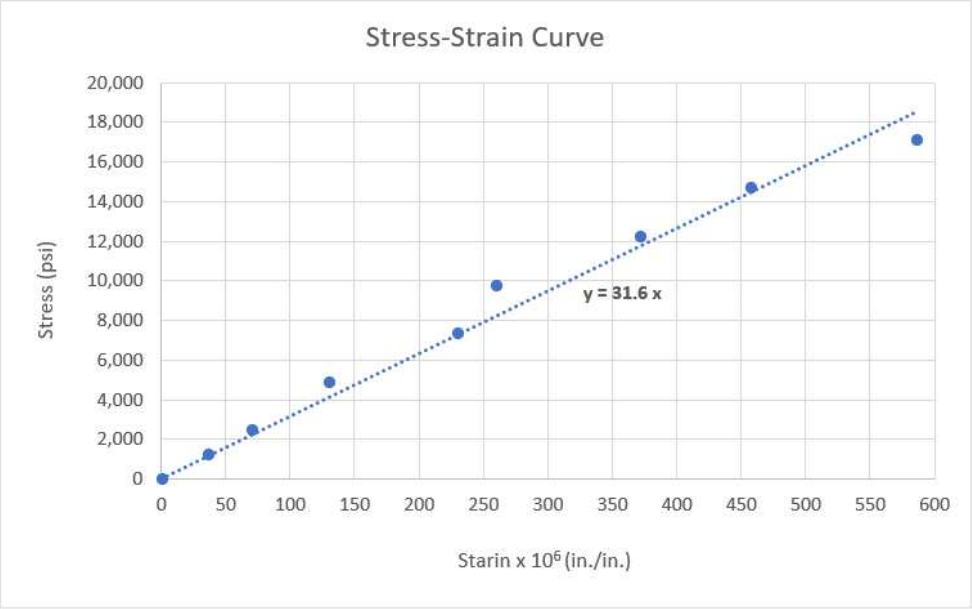

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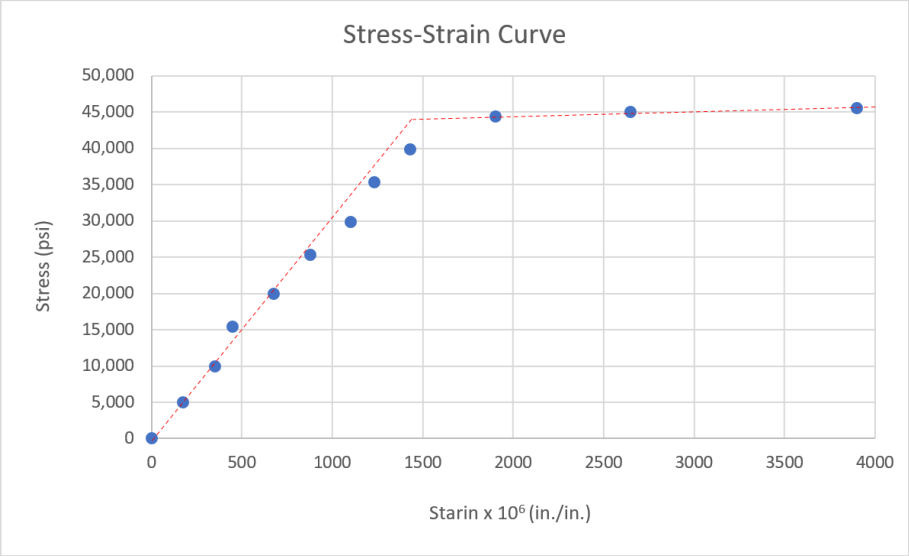

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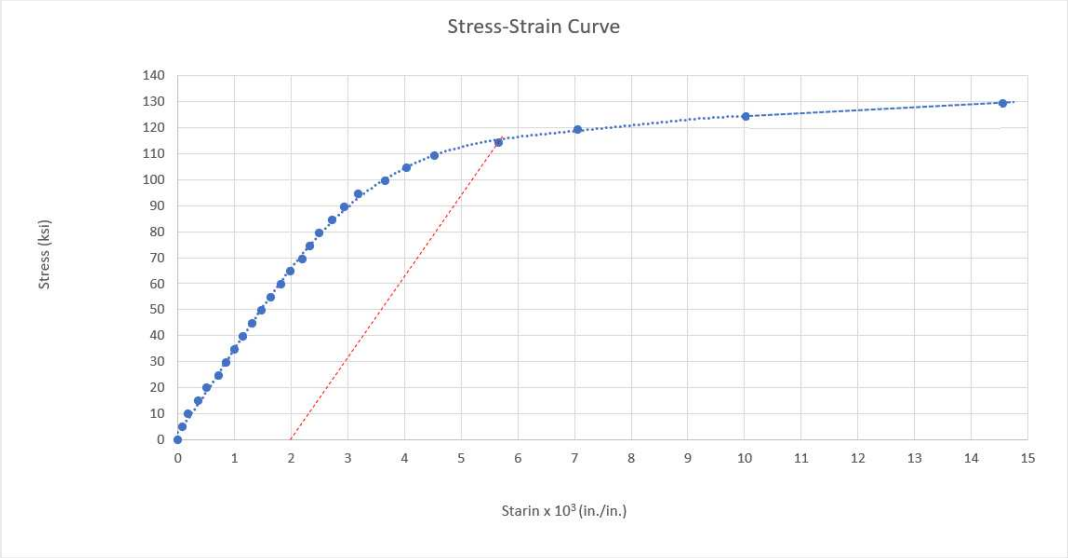

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