Steel Design 7th edition Segui Solutions Manual

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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)

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1.5-3

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

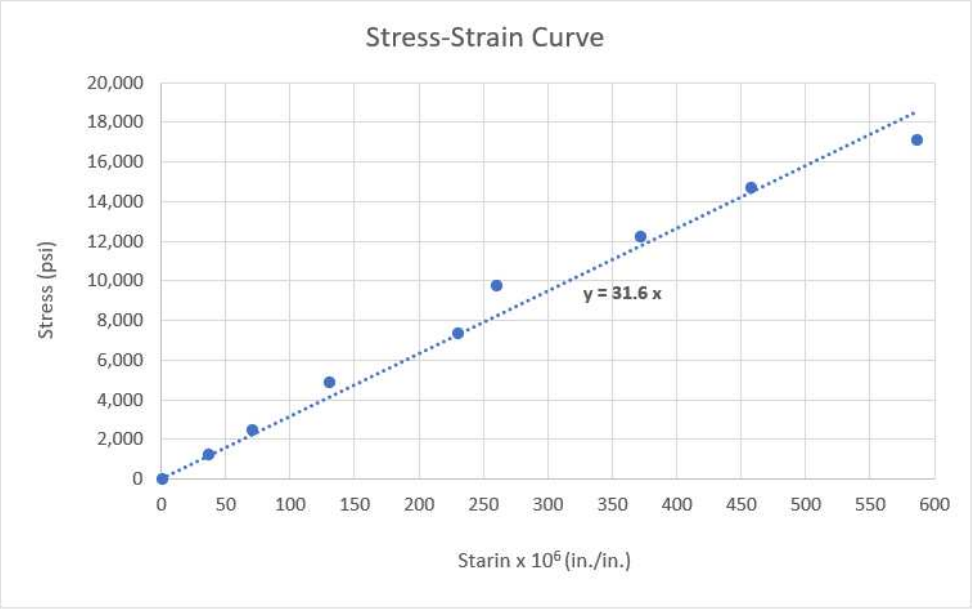
For $P = 250$ lb, $f = \frac{P}{A} = \frac{250}{0.2043} = 1224$ psi

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

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

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

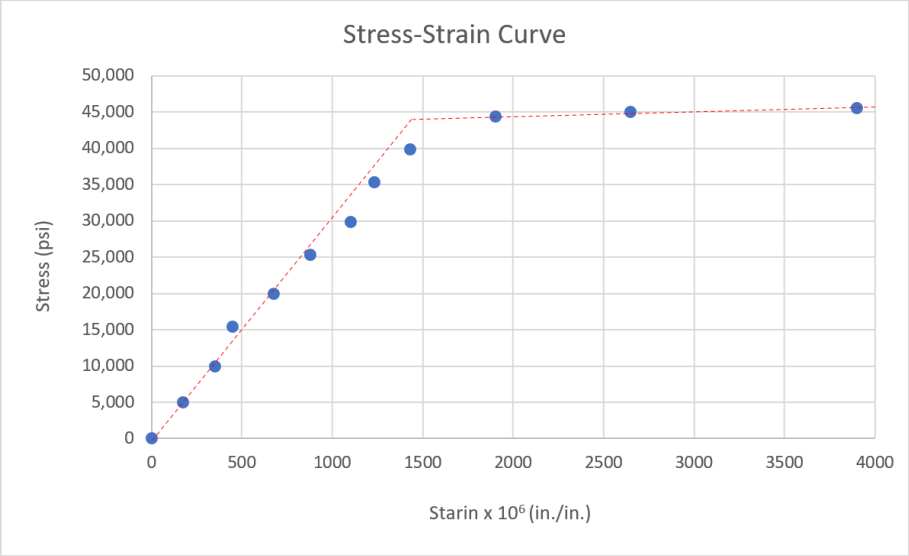
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3,900	2,460	1,230	35,326
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(b)



(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)

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1.5-6

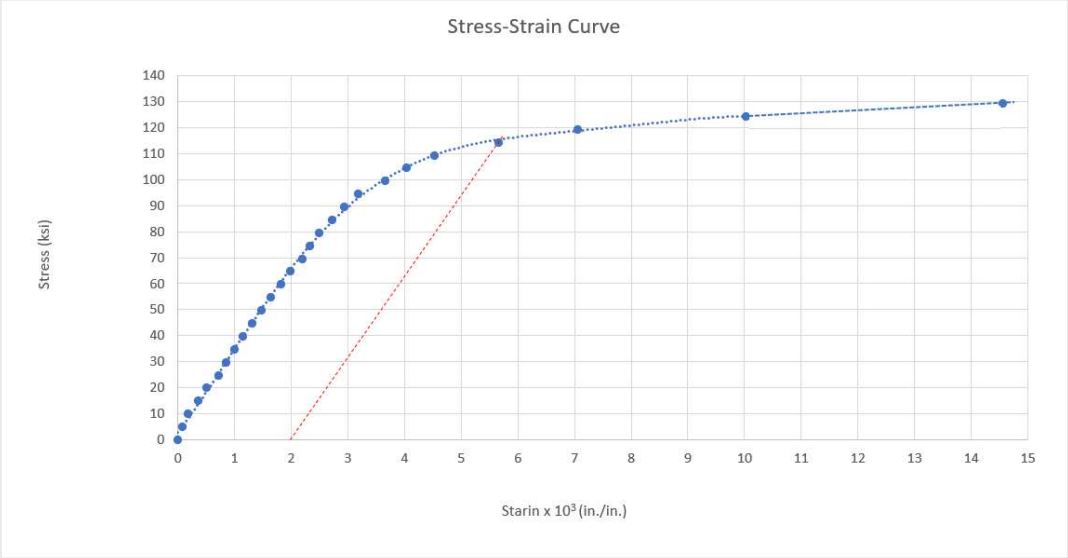
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2	0.352	0.176	9.945
3	0.706	0.353	14.918
4	1.012	0.506	19.891
5	1.434	0.717	24.863
6	1.712	0.856	29.836
7	1.986	0.993	34.809
8	2.286	1.143	39.781
9	2.612	1.306	44.754
10	2.938	1.469	49.727
11	3.274	1.637	54.699
12	3.632	1.816	59.672
13	3.976	1.988	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
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(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} ≈ 85 ksi (≈ 586 MPa)

F_y ≈ 116 ksi (≈ 800 MPa)

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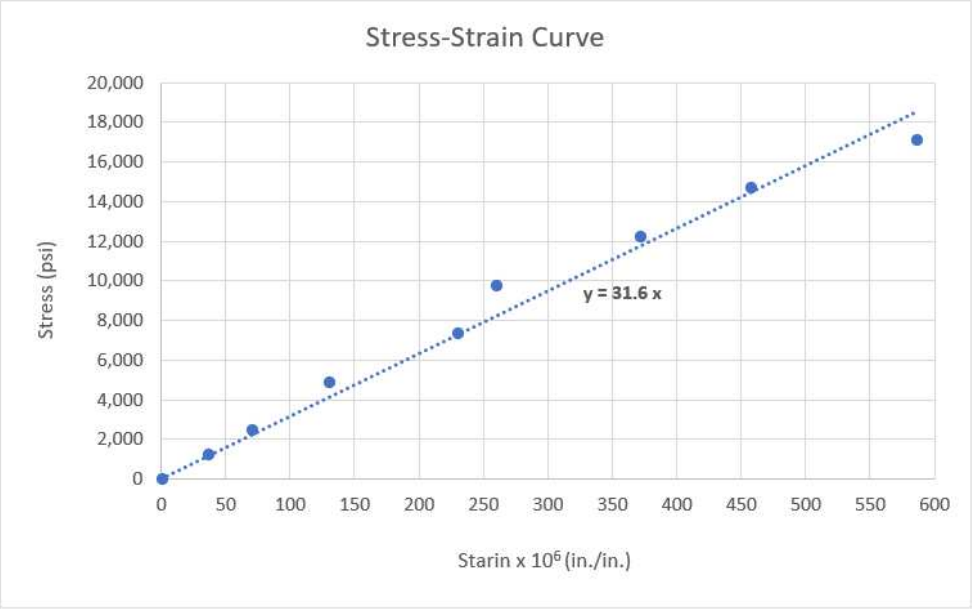
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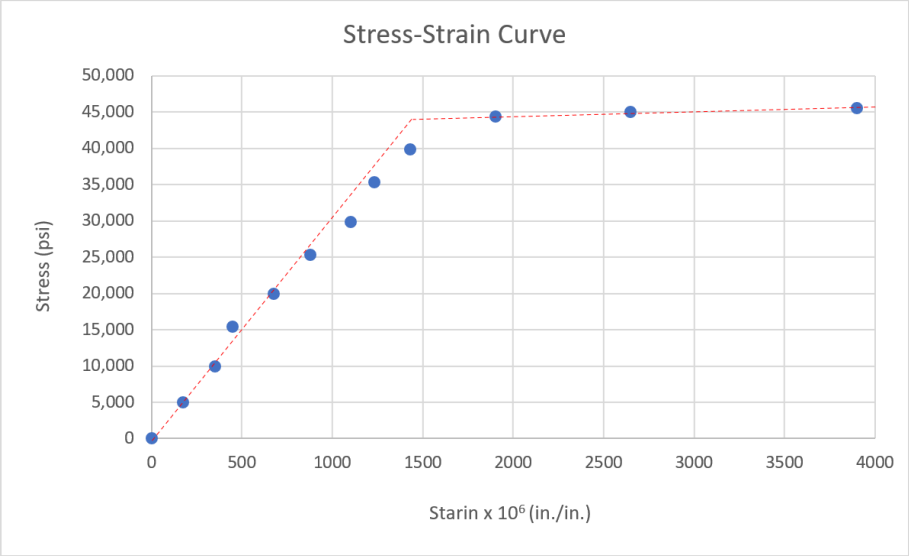
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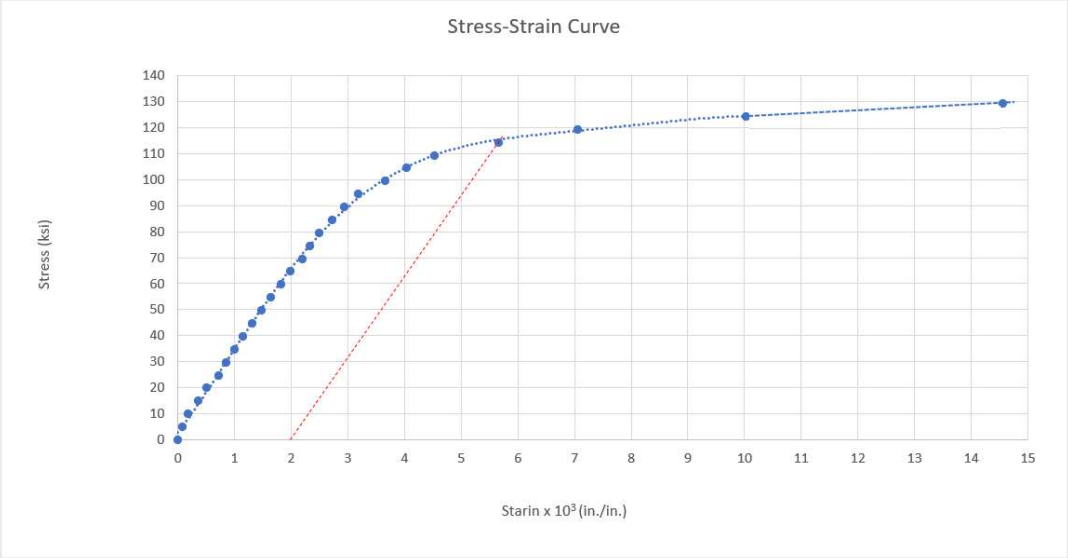
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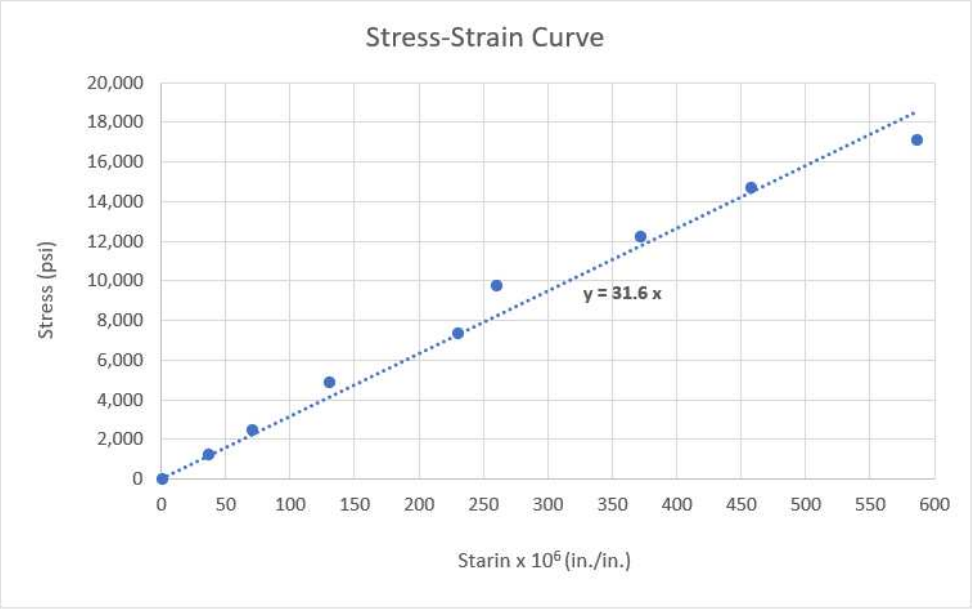
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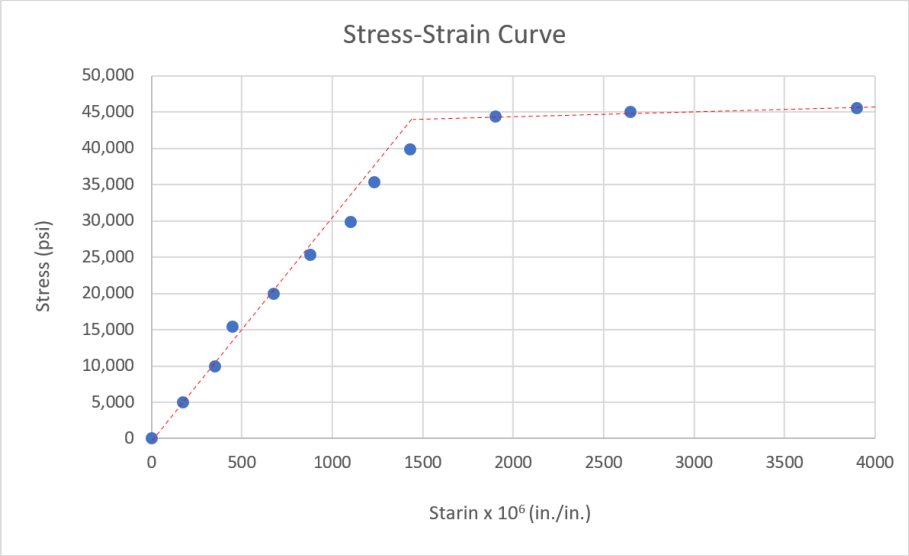
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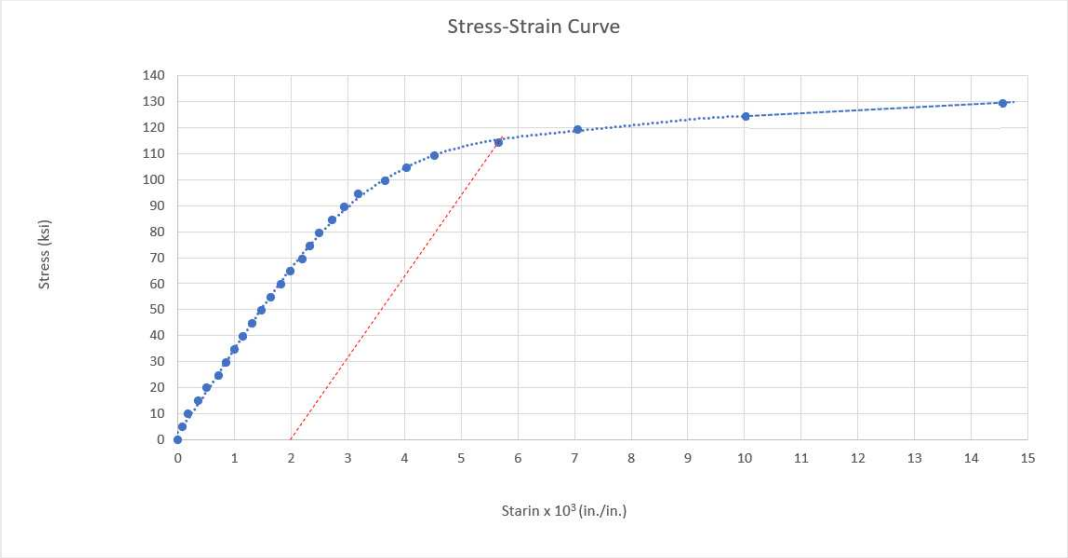
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