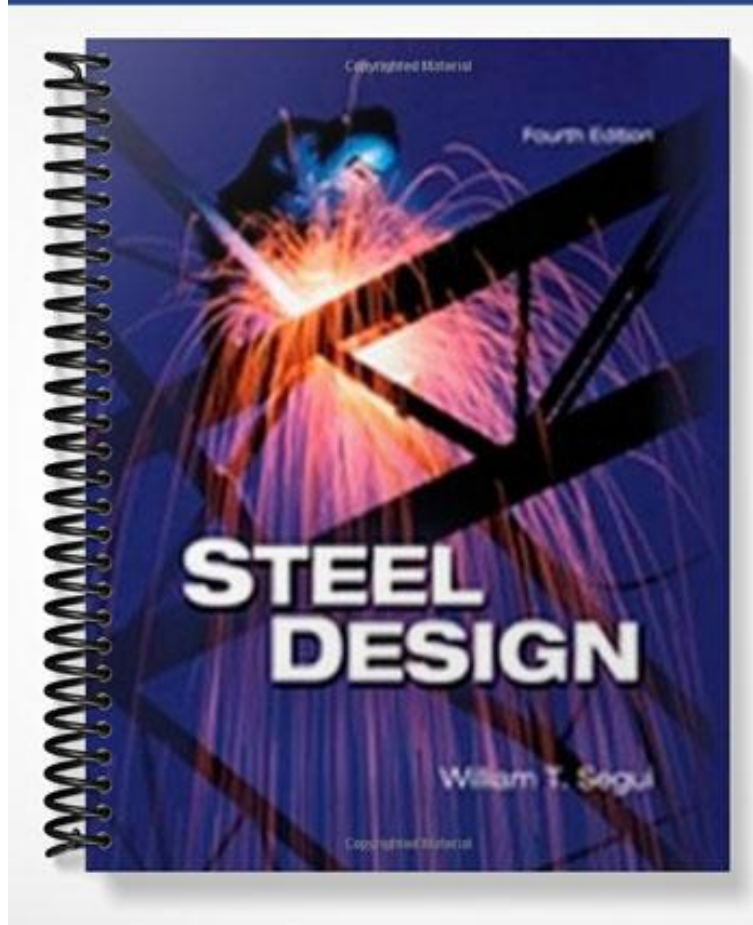
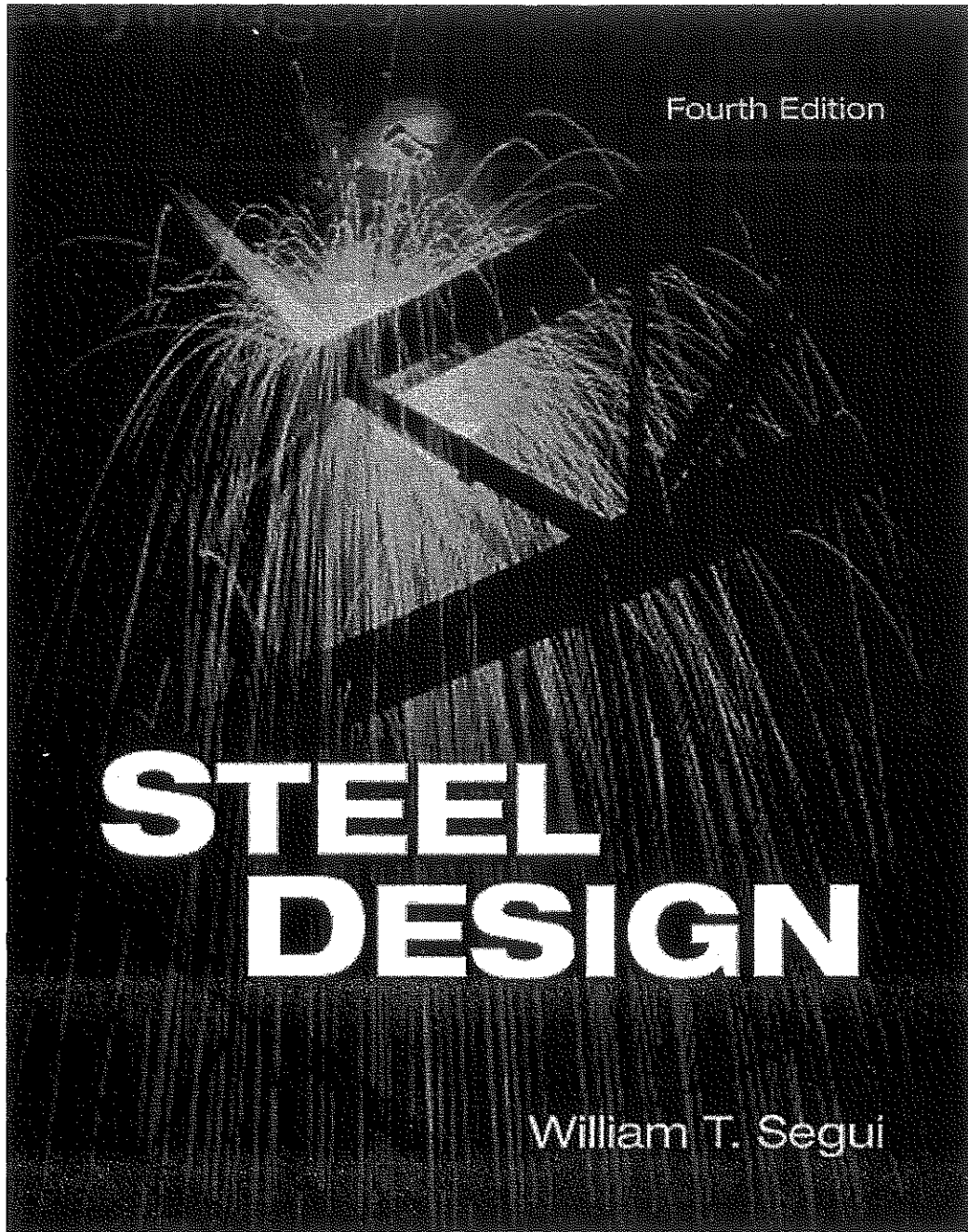


SOLUTIONS MANUAL



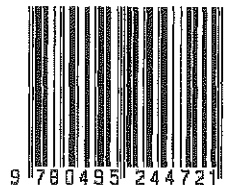
INSTRUCTOR'S SOLUTIONS MANUAL

to accompany



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be reproduced or used in any form or by any means—graphic, electronic, or mechanical,
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PREFACE

This instructor's manual contains solutions to the problems in Chapters 1-10 of *Steel Design*, 4th edition. Solutions to all problems are given, with the following exceptions: In Chapter 8 some of the ASD solutions are not given. In Chapters 9 and 10, only solutions to the problems whose answers appear in the Answers to Selected Problems section of the textbook are given.

In general, intermediate results to be used in subsequent calculations were recorded to four significant figures, and final results were rounded to three significant figures. Rounding was done according to the following practice: when the first digit to be dropped is less than 5, do not round up; when the first digit to be dropped is equal or greater than 5, add 1 to the last digit retained.

Students following these guidelines should be able to reproduce the numerical results given. However, the precision of the results could depend on the grouping of computations and on whether intermediate values are retained in the calculator between steps.

In many cases, there will be more than one acceptable solution to a design problem; therefore, the solutions given for design problems should be used only as a guide in grading homework.

I would appreciate learning of any errors you may discover. You can contact me at wseguie@memphis.edu. A list of errors and corrections will be maintained at

<http://www.ce.memphis.edu/seguie/errata.html>.

In some instances, there are inconsistencies between dimensions and properties given in the *Manual* and values given in the database on the Companion CD. When I encountered a discrepancy, I used the value given in the *Manual*.

William T. Segui
November 4, 2006



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CHAPTER 1 - INTRODUCTION

1.5-1

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

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

$$\underline{F_u = 120 \text{ ksi}}$$

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

$$\underline{e = 13.3\%}$$

(c)

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

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

$$\underline{\text{Reduction} = 38.9\%}$$

1.5-2

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

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

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

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

$$\underline{E = 29,500 \text{ ksi}}$$

1.5-3

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

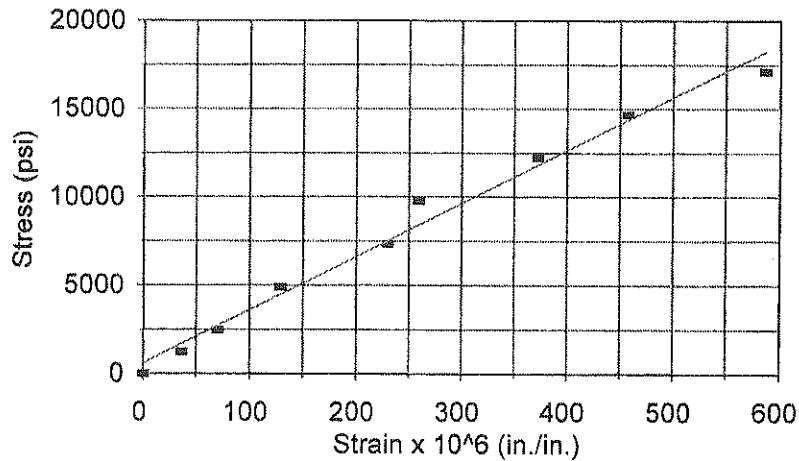
$$\text{For } P = 250 \text{ lb, } f = \frac{P}{A} = \frac{250}{0.2043} = 1224 \text{ psi}$$

Spreadsheet results:

(a)

Load (lb)	Stress (psi)	Strain x 10 ⁶ (in./in.)
0	0	0
250	1224	37.1
500	2447	70.3
1000	4895	129.1
1500	7342	230.1
2000	9790	259.4
2500	12237	372.4
3000	14684	457.7
3500	17132	586.5

(b)



(c)

$$E = \text{slope} = 30,100 \text{ ksi}$$

1.5-4

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

$$E = \frac{f}{\epsilon} = \frac{P/A}{\Delta L/L} = \frac{P}{\Delta L} \cdot \frac{L}{A} = 1392(4/0.1963) = 28,400 \text{ ksi}$$

$$E = 28,400 \text{ ksi}$$

1.5-5

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

$$\text{For } P = 550 \text{ lb, } f = \frac{P}{A} = \frac{550}{0.1104} = 4982 \text{ psi}$$

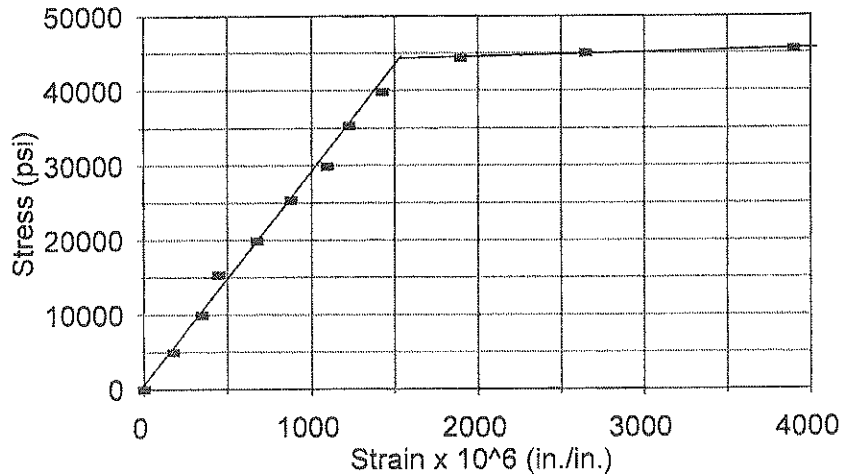
$$\epsilon = \frac{\Delta L}{L} = \frac{350 \times 10^{-6}}{2} = 175 \times 10^{-6}$$

Spreadsheet results:

(a)

Load (lb)	Elongation x 10 ⁶ (in.)	Stress (psi)	Strain x 10 ⁶ (in./in.)
0	0	0	0
550	350	4982	175
1100	700	9964	350
1700	900	15399	450
2200	1350	19928	675
2800	1760	25362	880
3300	2200	29891	1100
3900	2460	35326	1230
4400	2860	39855	1430
4900	3800	44384	1900
4970	5300	45018	2650
5025	7800	45516	3900

(b)



(c) $E = \text{slope} = \frac{15,000}{500 \times 10^{-6}} = 30,000,000 \text{ psi}$

$E = 30,000,000 \text{ psi}$

(d)

$F_y \approx 44,000 \text{ psi}$

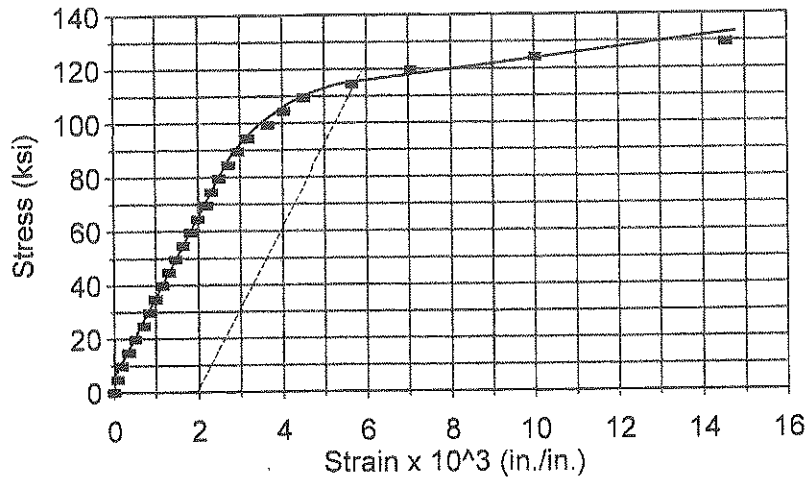
1.5-6

Spreadsheet results:

(a)

Load (kips)	Elongation x 10 ³ (in.)	Stress (ksi)	Strain x 10 ³ (in./in.)
0	0	0	0
1	0.16	4.973	0.080
2	0.352	9.945	0.176
3	0.706	14.92	0.353
4	1.012	19.89	0.506
5	1.434	24.86	0.717
6	1.712	29.84	0.856
7	1.986	34.81	0.993
8	2.286	39.78	1.143
9	2.612	44.75	1.306
10	2.938	49.73	1.469
11	3.274	54.70	1.637
12	3.632	59.67	1.816
13	3.976	64.64	1.988
14	4.386	69.62	2.193
15	4.64	74.59	2.320
16	4.988	79.56	2.494
17	5.432	84.54	2.716
18	5.862	89.51	2.931
19	6.362	94.48	3.181
20	7.304	99.45	3.652
21	8.072	104.4	4.036
22	9.044	109.4	4.522
23	11.31	114.4	5.655
24	14.12	119.3	7.060
25	20.044	124.3	10.02
26	29.106	129.3	14.55

(b)



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

$E = 30,000 \text{ ksi}$

(d)

$F_{pl} \approx 85 \text{ ksi}$

(e)

$F_y \approx 116 \text{ ksi}$

