Insstructor's Manual

to accompany

Statics and Strength of Materials For Architecture and Building Construction

Fourth Edition

Barry S. Onouye

PEARSON
Prentice Hall

Upper Saddle River, New Jersey
Columbus, Ohio

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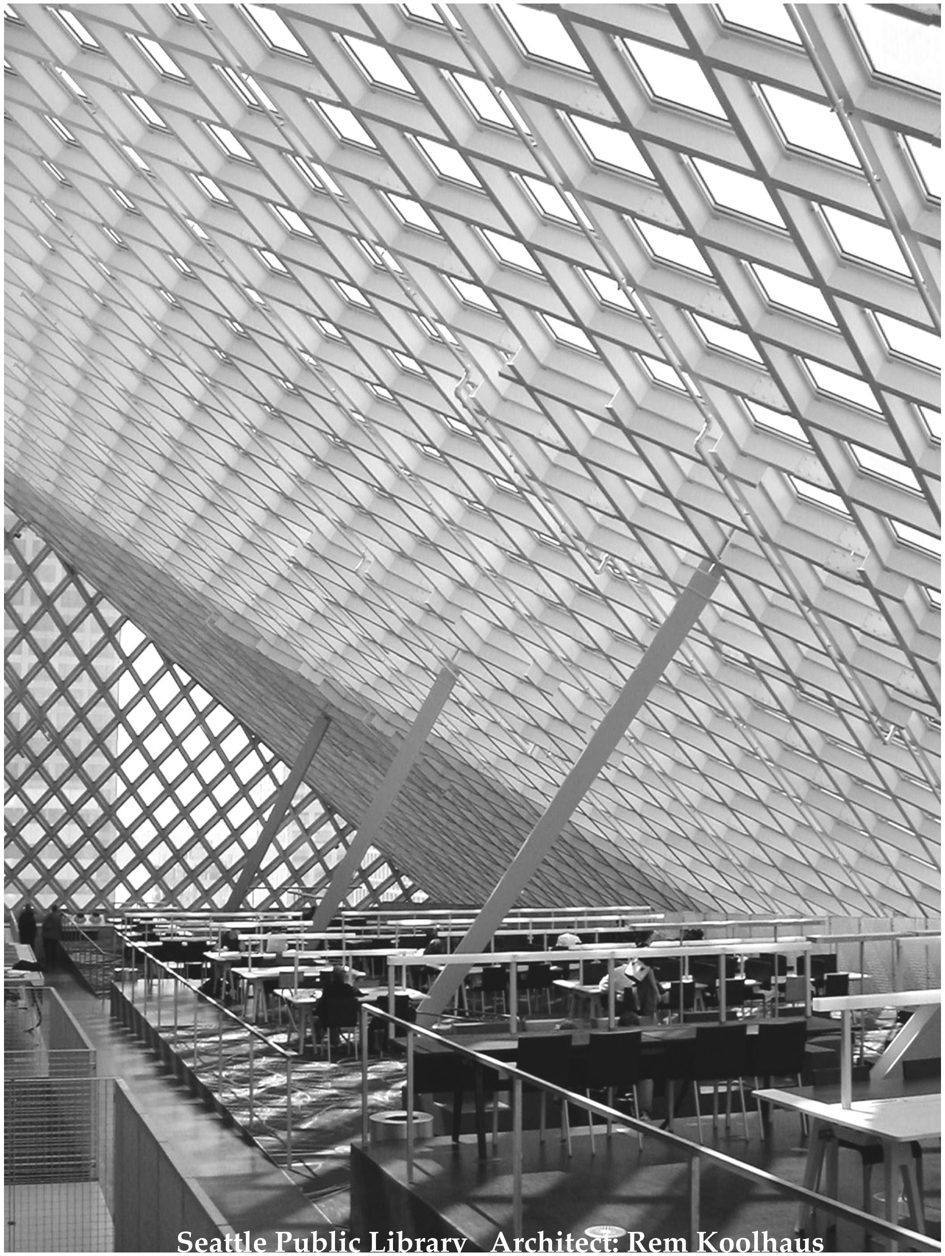

Instructor's Manual *to Accompany*

Statics and Strength of Materials

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Preface

This Instructor's Manual is intended to accompany Statics and Strength of Materials for Architecture and Building Construction.
It was initially developed as a study guide for students to practice on a variety of problems to enhance their understanding of the principles covered in the text. Solutions were developed in sufficient detail to allow students to use these problems as additional example problems.

Although the problem solutions contained in this Instructor's Manual have been worked, re-worked, checked and scrutinized by my many students over the years, there are inevitably errors that remain to be discovered by others using the book. If you detect discrepancies, omissions and errors as you work through these problems, I would appreciate hearing from you so that I can incorporate the changes for any future editions of the Instructor's Manual or book.

I realize that many instructors do not allow student's access to the Instructor's Manual but I have personally found that my students appreciated having it as a study guide.

Fall, 2010

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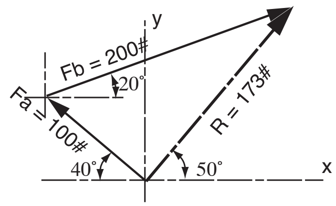
2.1



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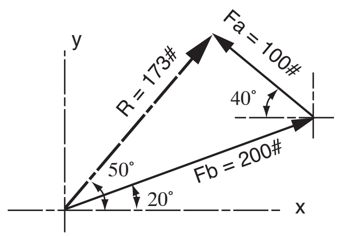

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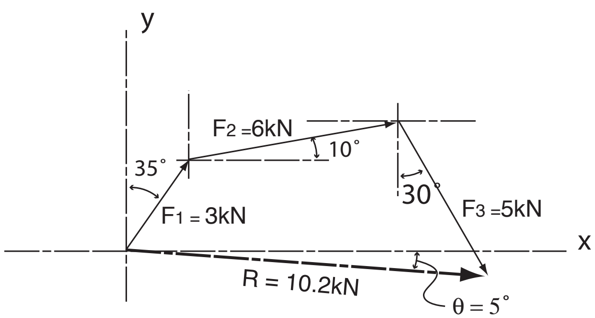

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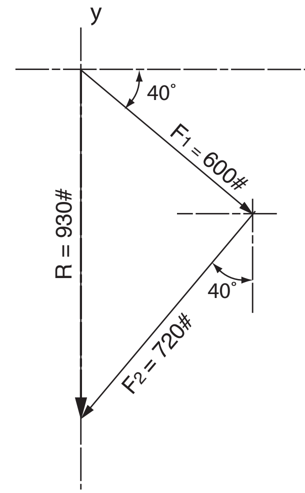

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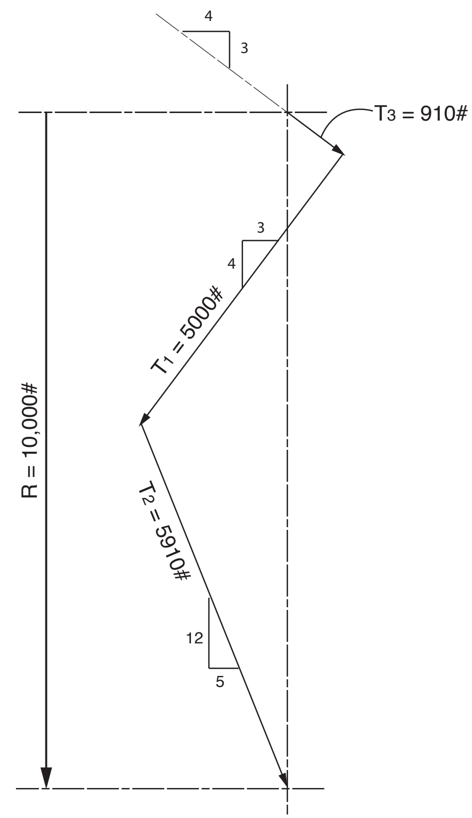

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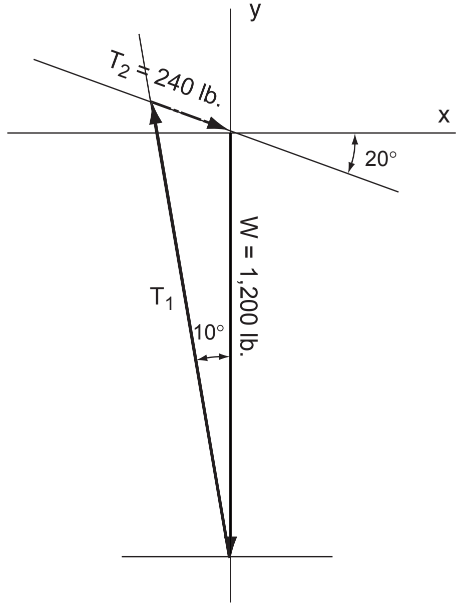

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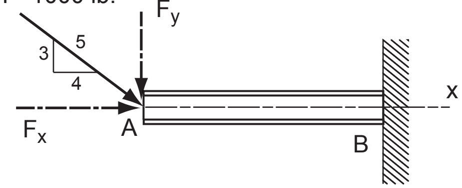
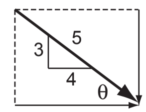




By similar triangles:

$$\frac{F_x}{4} = \frac{F_y}{3} = \frac{F}{5}$$

$$\therefore \; F_x = \tfrac{4}{5}F = \tfrac{4}{5}(1000\#) = 800\#$$

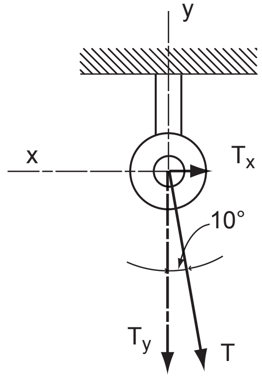
$$F_y = \tfrac{3}{5}F = \tfrac{3}{5}(1000\#) = 600\#$$

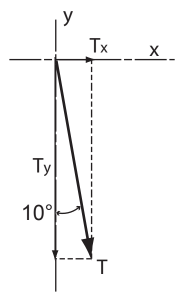
$$\sin\theta = \frac{3}{5} \quad \text{and} \quad \cos\theta = \frac{4}{5}$$

$$\therefore \; F_x = F\cos\theta = (1000\#)\left(\tfrac{4}{5}\right) = 800\#$$

$$F_y = F\sin\theta = (1000\#)\left(\tfrac{3}{5}\right) = 600\#$$

2.7



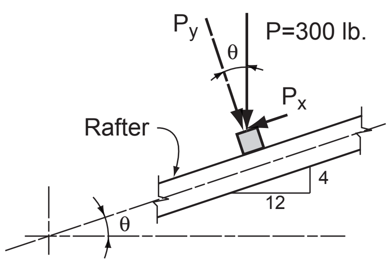


$$T_x = T\sin 10°$$

$$T_y = T\cos 10°$$

$$\therefore\ T = \frac{T_y}{\cos 10°} = \frac{250\text{N}}{0.985} = 254\text{N}$$

2.8



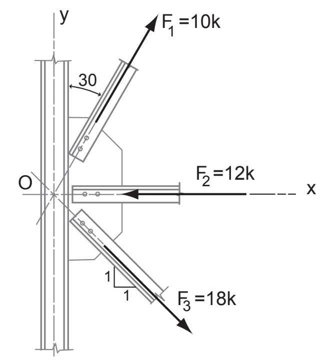
Purlin Detail

$$\theta = \tan^{-1}\left(\tfrac{4}{12}\right) = 18.43°$$

$$P_x = P\left(\tfrac{4}{12.65}\right) = (300\#)(0.316) = 94.9\#$$

$$P_y = P\left(\tfrac{12}{12.65}\right) = (300\#)(0.949) = 285\#$$

2.9



$$F_{1y} = +F_1\cos 30° = 10\text{k}(0.866) = 8.66\text{k}$$

$$F_{1x} = +F_1\sin 30° = 10\text{k}(0.50) = 5\text{k}$$

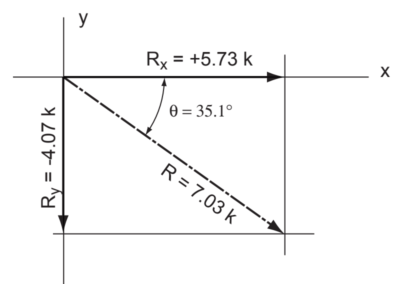
$$F_2 = -F_{2x} = -12\text{k}$$

$$F_{3x} = +\frac{1}{\sqrt{2}}(F_3) = +\frac{18\text{k}}{\sqrt{2}}$$

$$F_{3y} = -\frac{1}{\sqrt{2}}(F_3) = -\frac{18\text{k}}{\sqrt{2}}$$

$$R_x = \Sigma F_x = +5\text{k} - 12\text{k} + \frac{18\text{k}}{\sqrt{2}} = +5.73\text{k}$$

$$R_y = \Sigma F_y = +8.66\text{k} - \frac{18\text{k}}{\sqrt{2}} = -4.07\text{k}$$



Resultant

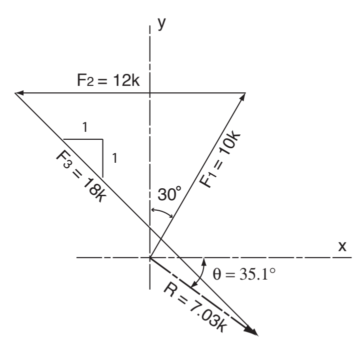
$$\tan\theta = \frac{R_y}{R_x} = \frac{4.07}{5.73} = 0.710$$

$$\theta = \tan^{-1}(0.710) = 35.4° \quad \text{from horizontal}$$

$$\sin\theta = \frac{R_y}{R}$$

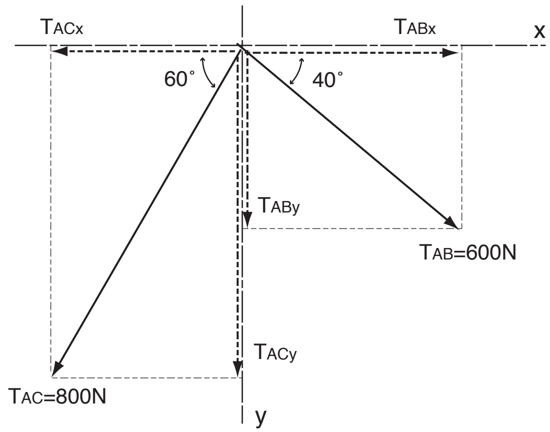
$$R = \frac{R_y}{\sin\theta} = \frac{R_y}{\sin 35.4°}$$

$$\therefore\ R = \frac{4.07\text{k}}{(0.579)} = 7.03\text{k}$$



Graphical solution using the tip-to-tail method

2.10



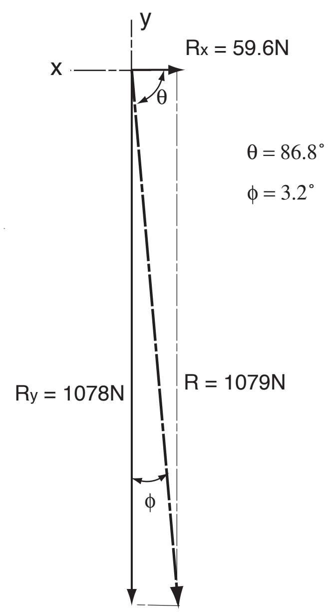
$$-T_{AC_x} = -T_{AC}\cos 60° = -0.5T_{AC}$$
$$-T_{ACy} = -T_{AC}\sin 60° = -0.866T_{AC}$$
$$+T_{AB_x} = +T_{AB}\cos 40° = +0.766T_{AB}$$
$$-T_{AB_y} = -T_{AB}\sin 40° = -0.642T_{AB}$$

$$R_x = \Sigma F_x = -(0.5)(800\text{N}) + (0.766)(600\text{N}) = 59.6\text{N}$$
$$R_y = \Sigma F_y = -(0.866)(800\text{N}) - (0.642)(600\text{N}) = -1078\text{N}$$

$$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \tan^{-1}\left(\frac{1078}{59.6}\right) = \tan^{-1}(18.1) = 86.8°$$

$$\phi = \tan^{-1}\left(\frac{R_x}{R_y}\right) = \tan^{-1}\left(\frac{59.6}{1078}\right) = \tan^{-1}(0.055) = 3.2°$$

$$R = \sqrt{59.6^2 + 1078^2} = 1079\text{N}$$



2.10 cont'd

Graphical Solution: