Arch 314
Structures I

Fall 2025 Recitation 004

Peter von Bülow
Amely Wackerbauer

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Recitation 004

Welcome to session 7!

- Bridge testing on **Monday!!**
- Quick Recap of this week's lecture (+ part of last week's)
- Homework Review (#10 Elastic Deformation)
- Lab: Stress & Strain Elasticity

Feel free to ask questions anytime

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BRIDGE TESTING MONDAY! :0

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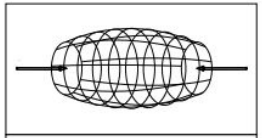
Lecture: Stress and Strain (10/22)

Stress and Strain

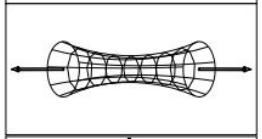
- Stress
- Strain
- Analysis – ASD vs. LRFD
- Modes of Failure

Types of Stress

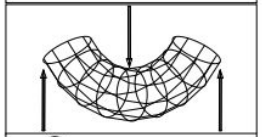
- Compression $\sigma = \frac{P}{A}$



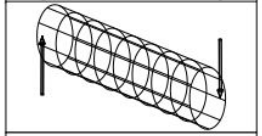
- Tension $\sigma = \frac{P}{A}$



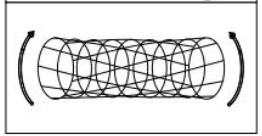
- Flexure $\sigma = \frac{M\ c}{I}$



- Shear $\tau = \frac{P}{A} or \frac{VQ}{Ib}$



- Torsion $\tau = \frac{T\ r}{J}$



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Lecture: Elasticity and Deformation (10/31)

Young's Modulus

material stiffness

$$E = \frac{P/A}{D/L} = \frac{\sigma}{\varepsilon}$$

Stress

Stress is the result of some force being applied to an area of some material.

$$\sigma = \frac{P}{A}$$

Strain

Strain is the amount of deformation in the material, per unit length.

$$\varepsilon = \frac{D}{L}$$

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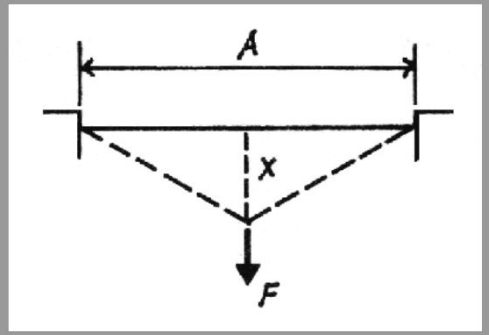
HW #10: Elastic Deformation

10. Elastic Deformation

Find the final stretched length of the cable deflected distance x, and the load F needed to cause the deflection. Determine the resulting tensile force in the cable along with the stress and strain.



DATASET: 2 -1- -3-

Original Unstretched Length: A	54 FT
Streched Deflection: x	2.25 FT
Cable Area	1.255813953 IN^2
Young's Modulus: E	20980 KSI

Your answer was correct.
You scored 5 points.

#	Question	Your Response	Correct Answer	Score
1	Full length of cable stretched x feet	54.186 FT	54.1872 FT	5
2	The amount the cable is stretched (deformation)	0.186 FT	0.187176 FT	5
3	Force in the stretched cable	89.579 KIPS	91.3243 KIPS	5
4	Horizontal component of the force in the cable	89.27 KIPS	91.0088 KIPS	5
5	Vertical component of the force in the cable	7.44 KIPS	7.58407 KIPS	5
6	Force F needed to cause the stretch, x, in the cable	14.88 KIPS	15.1681 KIPS	5
7	Stress in the cable	71.332 KSI	72.7212 KSI	5
8	Strain of the cable	0.0034 IN/IN	0.00346621 IN/IN	5

Current Score: 40 / 40

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HW #10: Elastic Deformation

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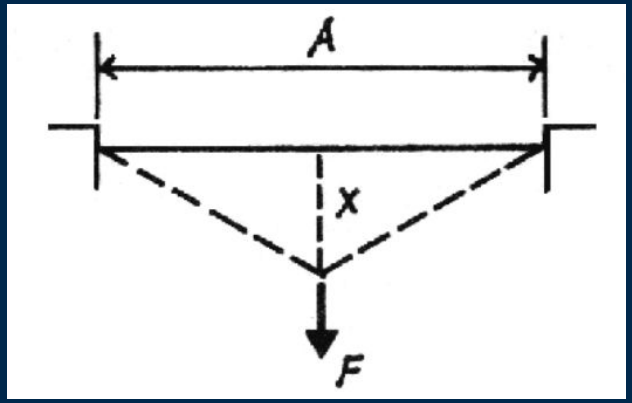

1. Full length of cable stretched x feet

$\frac{A}{2}$, x, $\frac{L_f}{2}$

$$\frac{L_f}{2} = \sqrt{x^2 + \left(\frac{A}{2}\right)^2}$$

$$L_f = 2\left(\sqrt{(2.25)^2 + \left(\frac{54}{2}\right)^2}\right)$$

$$\boxed{L_f = 54.186'}$$

2. Deformation of stretched cable

$$D = L_f - L_o = 54.186' - 54' = \boxed{0.186'}$$

#1 A

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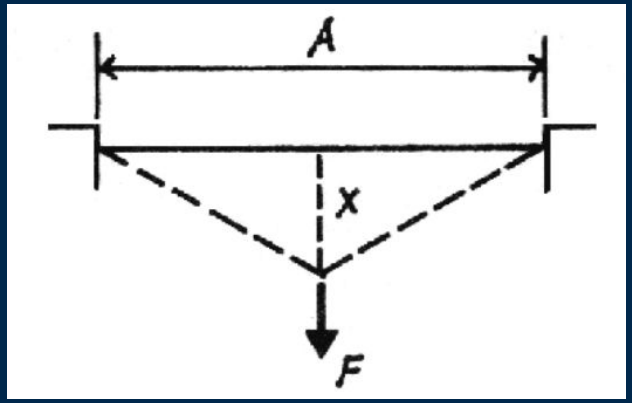

8. Strain of cable

Strain $\varepsilon = \frac{\delta}{L_o} = \frac{0.186'}{54'} = 0.0034\ in/in$ ← Answer to #8

(δ: Deformation, #2; L_o: Original length; 54': A)

7. Stress of cable

$E = \frac{\sigma}{strain} \rightarrow 20980 = \frac{\sigma}{0.0034}$ (20980: given (E); 0.0034: #8)

$0.0034(20980) = stress$

$= 71.332\ KSI$ ← Answer to #7

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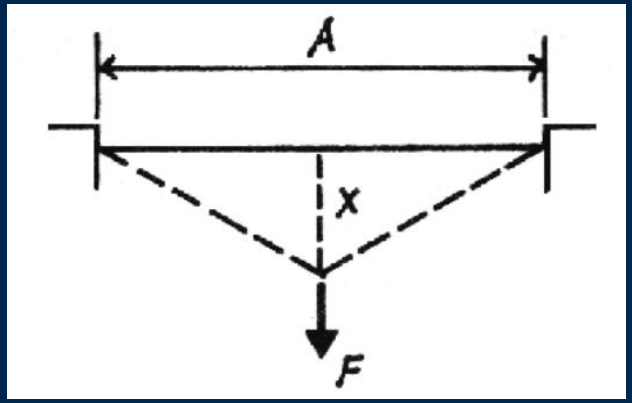

3. Force in stretched cable

$\sigma = \frac{P}{Area} \rightarrow 71.332 = \frac{P}{1.2558}$ – given

#9

$1.2558(71.332) = P$

$P = 89.579 KIPs$

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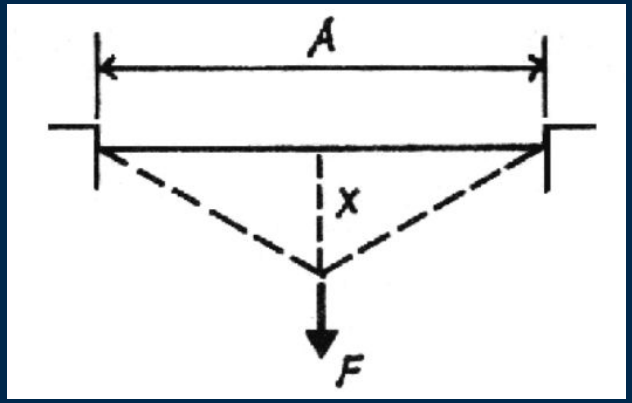

4. Horizontal component of force

$\frac{P_x}{A/2} = \frac{P}{L/2}$

$\frac{P_x}{\text{given } 54/2} = \frac{89.579\ (\#3)}{\frac{54.186}{2}\ (\#1)}$

* cross multiply *

$\frac{27.093 P_x}{27.093} = \frac{2,418.683}{27.093}$

$P_x = 89.27 \text{ KIPS}$

5. Vertical component of force

$\frac{P_y}{x} = \frac{P}{L/2}$

$\frac{P_y}{\text{given } 2.25} = \frac{89.579\ (\#3)}{\frac{54.186}{2}\ (\#1)}$

$\frac{27.093 P_y}{27.093} = \frac{201.55}{27.093}$

$P_y = 7.44 \text{ KIPS}$

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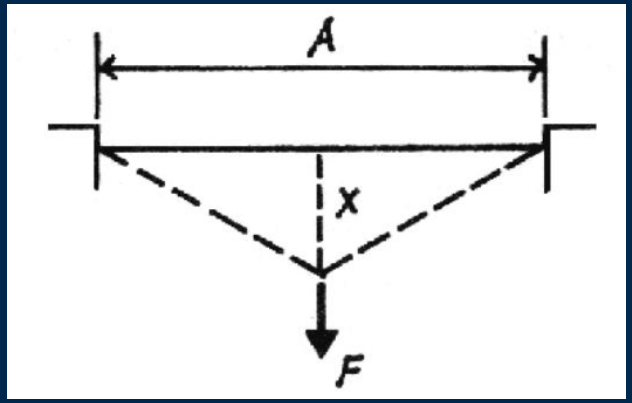

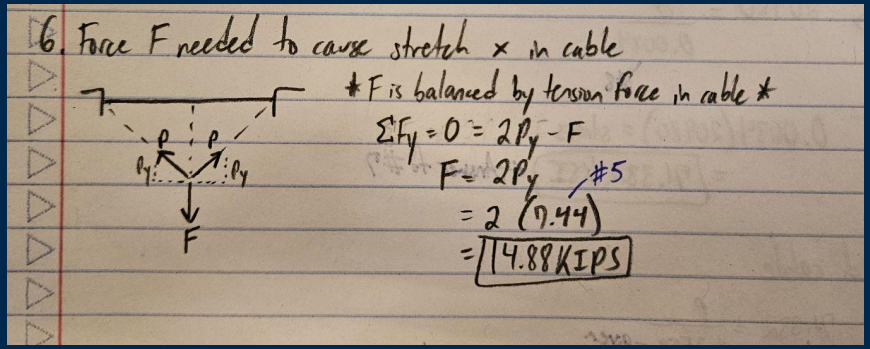

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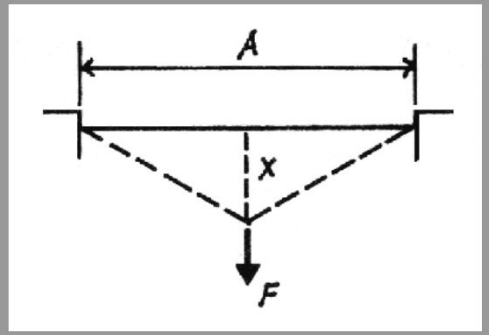

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LAB!

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