http://tinyurl.com/WPITrussMe

A modified approach to POE Unit 2

Welcome!

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Part 1: Statics

Unit 2.1 Statics

2.1.0 Right Triangle Math
Feb 23 | 10 pts

2.1.4 Force Vectors
Mar 5 | 10 pts

2.1.3 Free Body Diagrams
Mar 1 | 5 pts

2.1.5 Calculating Moments
Mar 11 | 10 pts

2.1.6 Truss Calculations
Mar 23 | 10 pts

2.1 Test - Kisker 2017-18
21 pts

2.1 Bonus Truss Problem
Mar 22 | 0 pts

2.1.7 Calculating Truss Forces
Apr 4 | 5 pts

Part 2: Material Properties

Unit 2.2 Material Properties

2.1.1 Centroids

2.1.1b Centroids: The Ropes
Apr 10 | 10 pts

2.1.2 Beam Deflection
Apr 8 | 5 pts

2.1.2a Moment of Inertia

Stress/Strain Calculations
Apr 20 | 16 pts

2.3.2 Tensile Testing

Part 3: Bridge Design

2.1.8 Bridge Project Instructions and Overview		⊘ ⋮
2.1.8 Initial Research Apr 25 | 15 pts		⊘ ⋮
2.1.8 Bridge Justification Apr 27 | 25 pts		⊘ ⋮
2.1.8 Construction & Testing May 14 | 50 pts		⊘ ⋮
2.1.8 Bridge Evaluation May 15 | 20 pts		⊘ ⋮
2.1.8 Bridge Reflection May 15 | 20 pts		⊘ ⋮

FOR MEMBERS THAT ARE IN TENSION

Description	Symbol	Value	Unit	Information Source
Member Base	b		in	Dial Calipers
Member Height	h		in	Dial Calipers
Cross-Sectional Area	A		in^2	EXCEL FORMULA: base x height
Tension Capacity, Spruce No. 3, 2" and wider	Ftn	1012	psi	Look Up Online
Moment of Inertia (Vert)	Ixx		in^4	EXCEL FORMULA: (base x height^3)/12
Allowable Tension Force	Ft		lb	EXCEL FORMULA: Cross-Sectional Area x Tension Capacity

Note that member length was not included in these calculations. That's because it doesn't have an appreciable effect for members in tension!

Calculations and graphs for members in **compression** are on the other tab.

Strength Calculations

FOR MEMBERS THAT ARE IN COMPRESSION

| Description	Symbol	Value	Unit	Information Source
Member Base	b		in	Dial Calipers
Member Height	h		in	Dial Calipers
Member Length	l		in	Ruler/Meter Stick
Cross-Sectional Area	A		in^2	EXCEL FORMULA: base x height
Moment of Inertia (X)	Ixx		in^4	EXCEL FORMULA: (base x height^3)/12
Moment of Inertia (Y)	Iyy		in^4	EXCEL FORMULA: (height x base^3)/12
Ultimate Compression Stress Capacity, Spruce, No. 3, 2" and Wider	Fcn	2340	psi	(From an online source)
Ultimate Compression Force Capacity	Fc,max		lb	EXCEL FORMULA: Compression Capacity x Cross-Sectional Area
Effective Length Factor	K	0.65	(fixed-fixed)	(From an online source)
Slenderness Ratio, Base	Kl/b			EXCEL FORMULA: K value * panel length / member base
Slenderness Ratio, Height	Kl/h			EXCEL FORMULA: K value * panel length / member height
Modulus of Elasticity	Eminn	1056000	psi	(From an online source)
Buckling and Crushing Factor	c	0.8		(From an online source)
Euler Critical Buckling Stress for Columns about x-axis	FcEn,b		psi	EXCEL FORMULA: 0.822 x (Mod of Elasticity) / Slenderness Ratio, Base^2
Euler Critical Buckling Stress for Columns about y-axis	FcEn,h		psi	EXCEL FORMULA: 0.822 x (Mod of Elasticity) / Slenderness Ratio, Height^2
Column Stability Factor about x-axis	Cp,b	#DIV/0!		EXCEL FORMULA: Too long to show here
Column Stability Factor about y-axis	Cp,h	#DIV/0!		EXCEL FORMULA: Too long to show here
Adjusted Ultimate Compression Force Capacity about x-axis	Fc,b		lb	EXCEL FORMULA: Cp, b times Fc, max
Adjusted Ultimate Compression Force Capacity about y-axis	Fc,h		lb	EXCEL FORMULA: Cp, h times Fc, max

Calculations for members in **tension** are on the other tab.

Definitions (For Your Information)

"**Ultimate**" is the starting point for the design in the real world. In the real world, they multiply these values by a "factor of safety" before building.

Ultimate Crushing Force = The force at which the wood will crush (no buckling)

Euler Critical Buckling Stress for Columns = slightly modified Euler buckling equation, specific for rectangular sections; this is the stress at which the column will buckle

Column Stability Factor = defines the column curve or column equation about an axis

Adjusted Ultimate Compression Force = Force at which the column will fail in compression due to buckling about an axis

With a rectangular piece of lumber, one axis will be the "**strong**" axis and one will be the "**weak**" axis.

Strength Calculations
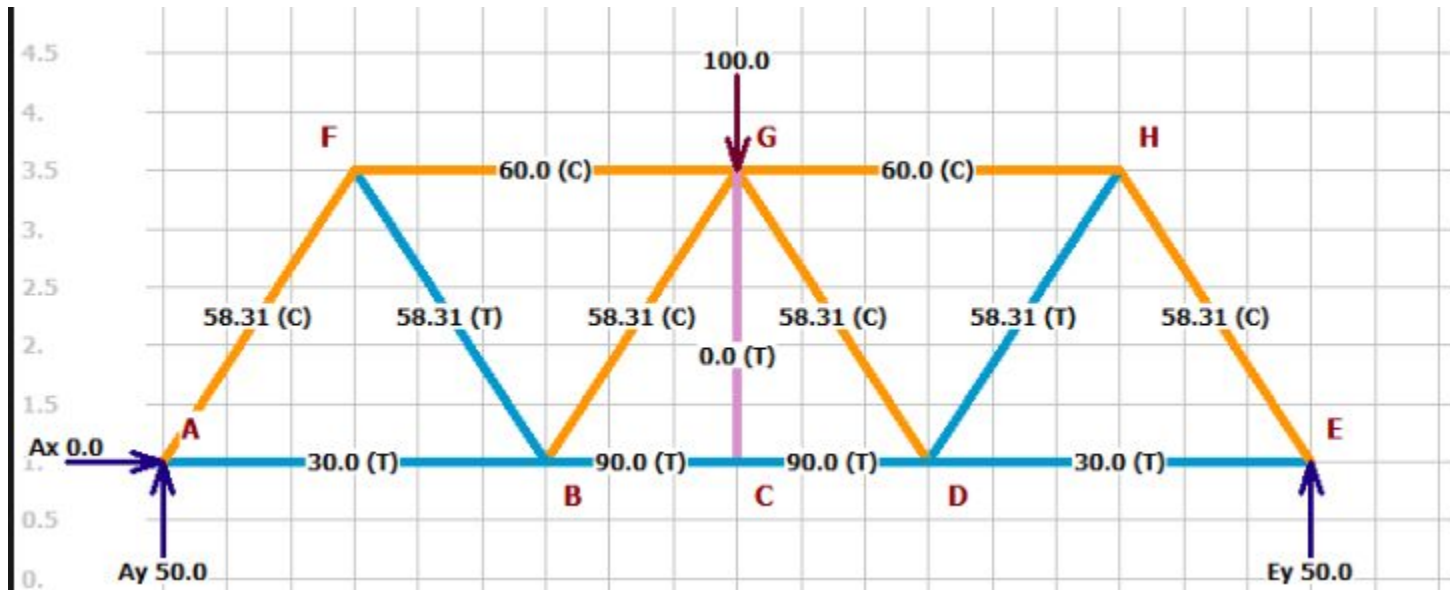
Use the Spreadsheet to Determine Truss Strength in MDSolids
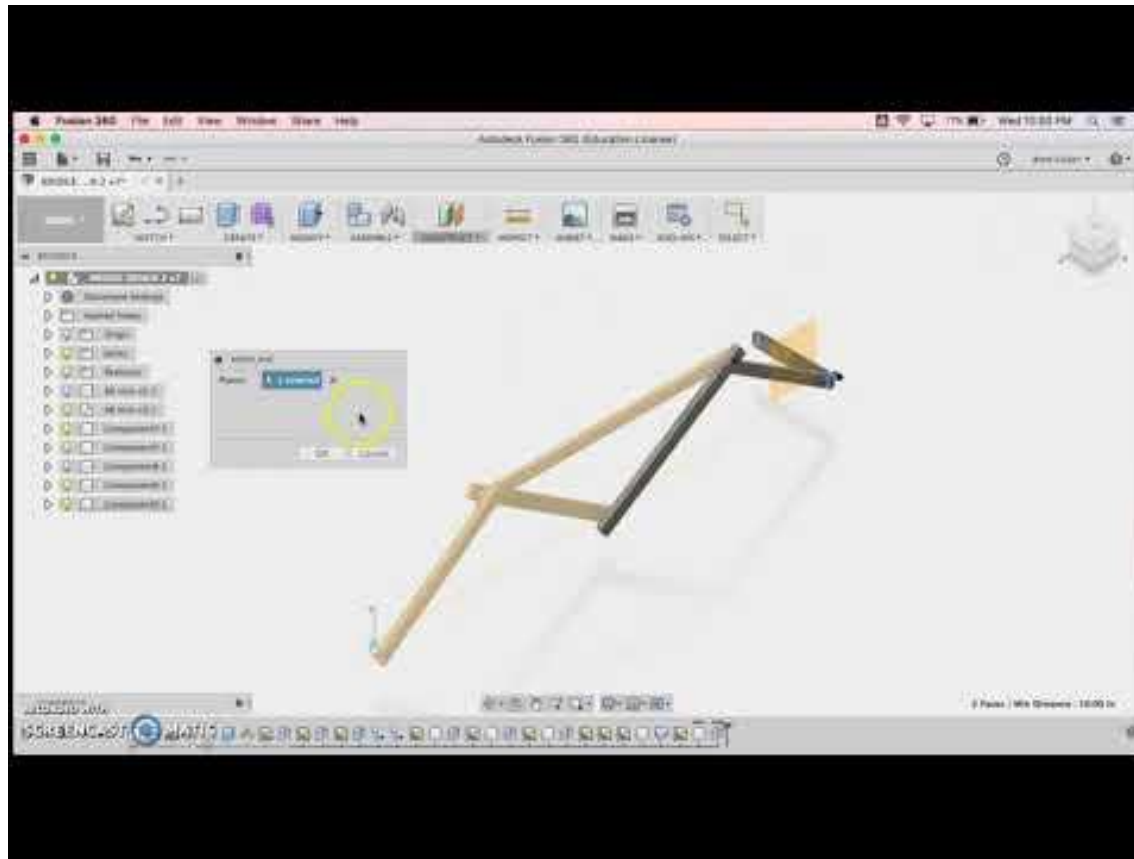
3D Modeling - To figure out your cuts!

Construction

Finished Product

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Testing

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Testing

Thank You!

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