PROJECT ONE: MILESTONE 3A – COVER PAGE

Team Number: 03

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Ethan Zamora	zamore2
David Thornton	thorntod
Kartik Chaudhari	chaudk4
Nelson Sam	samn2

MILESTONE 3A (STAGE 1) – MATERIAL SELECTION: PROBLEM DEFINITION

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1. Copy-and-paste the title of your *assigned* scenario in the space below.

The Roof Generator

2. MPI selection
   - List one primary objective and one secondary objective in the table below
   - For each objective, list the MPI
   - Write a short justification for your selected objectives

	Objective	MPI-stiffness	MPI-strength	Justification for this objective
Primary	Durability	E/ρ	E	There are high winds which occur in Calgary, which insinuates that the durability of the wind blade is essential to the project. In order to efficiently utilize the full utility of the winds, the wind turbine blades must be able to withstand the high winds. In addition to the high winds, the turbine blade must be able to withstand erosion and other hazards which will physically hinder its performance.
Secondary	Eco-friendly	$E/\rho CO2$	$E/\rho Hm$	When customers are deciding to buy a turbine to substitute the electric source they see if the product produces less carbon emission than what they're already using. So, in the perspective of the customer a product that is green while making it and a product that is green after production is what the customer wants.

MILESTONE 3A (STAGE 2) – MATERIAL SELECTION: MPI AND MATERIAL RANKING

Document the results of your materials selection and ranking on the following page.

→ Each team member is required to complete this on the *INDIVIDUAL* worksheet document, and then copy-and-paste to this document

We are asking that you submit your work on both worksheets**.** It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their summary of material property charts with the **Milestone Three-A Individual Worksheets** document so that it can be ***graded***
- Compiling your individual work into this **Milestone Three-A Team Worksheets** document allows you to readily access your team member's work
    - This will be especially helpful when completing ***Stage 3*** of the milestone

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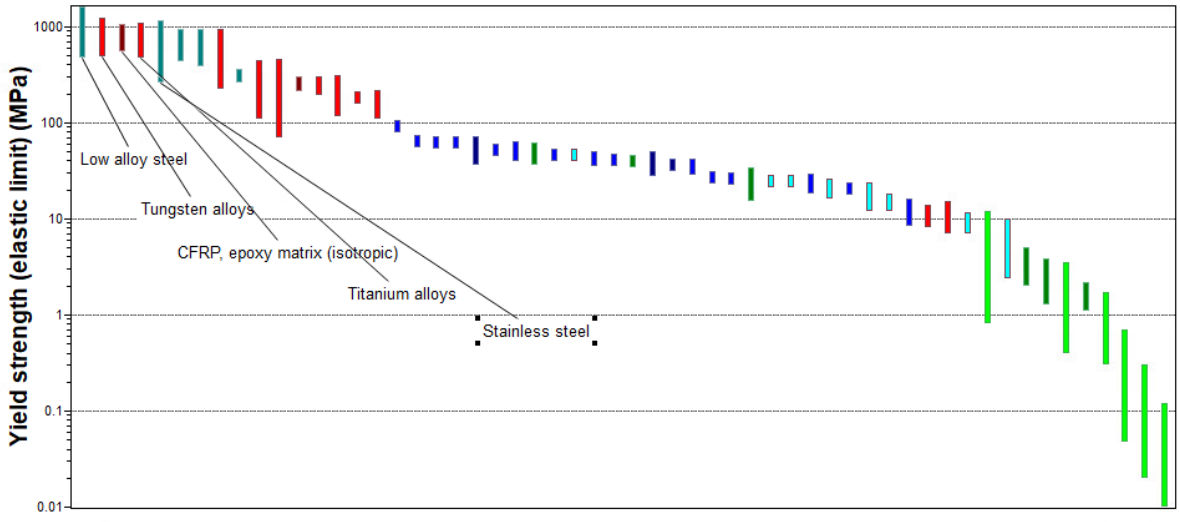
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Kartik Chaudhari	chaudk4

Material Property Chart

Assigned MPI #1	Functional Constraint	Objective
E	Our deflection d is less than some value d* (d < 10.36mm*)	Durability

Insert a screenshot of the material property chart with MPI guideline. Please clearly label the top 5 materials with their name in the plot.



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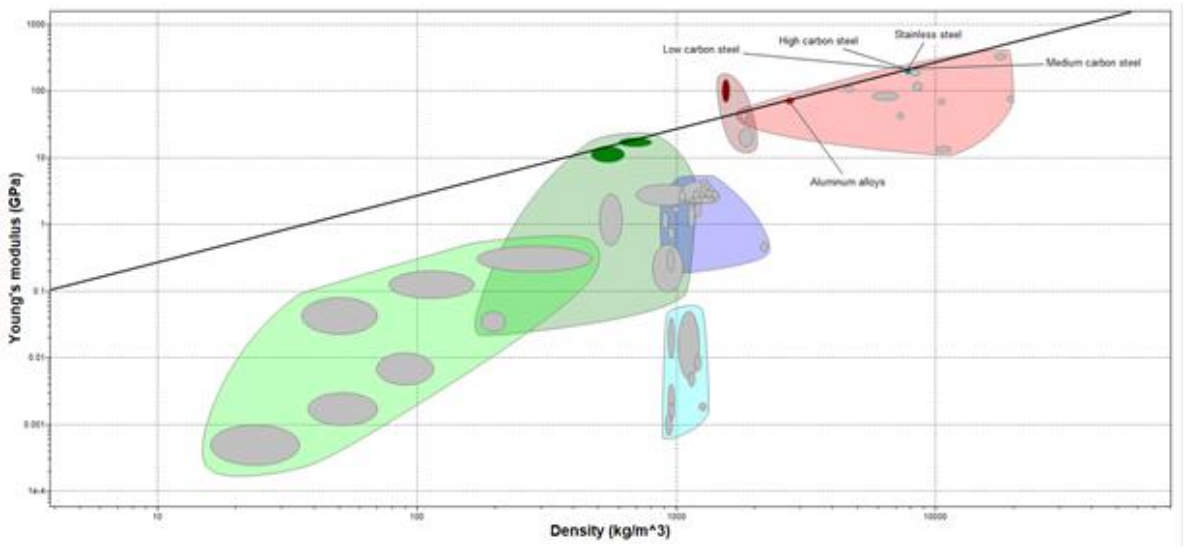
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
David Thornton	thorntod

Material Property Chart

Assigned MPI #2	Functional Constraint	Objective
MPI(mass)=Yield Strength(GPa)/Density(Kg/m^3)	Deflection d is less than d* (d<d*) [d*= 10.36mm]	Minimize Mass

Insert a screenshot of the material property chart with MPI guideline. Please clearly label the top 5 materials with their name in the plot.



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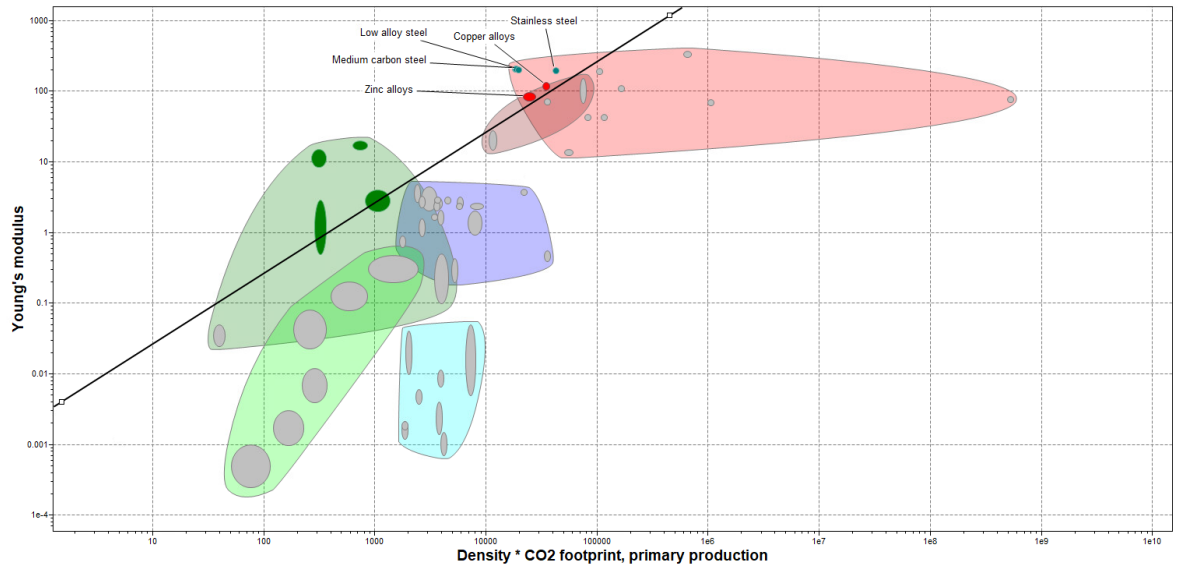
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Ethan Zamora	zamore2

Material Property Chart

Assigned MPI #3	Functional Constraint	Objective
E/ ρ CO2	Our deflection d is less than some value d* (d < 10.36mm*)	Eco- Friendly

Insert a screenshot of the material property chart with MPI guideline. Please clearly label the top 5 materials with their name in the plot.



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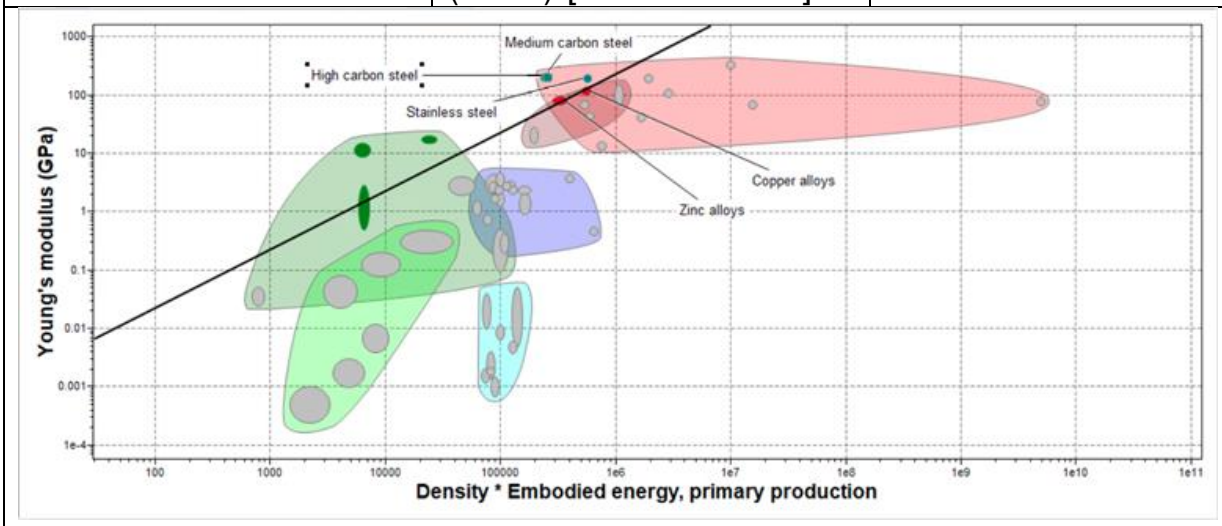
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Nelson Sam	samn2

Material Property Chart

Assigned MPI #4	Functional Constraint	Objective
Yield Strength/(p*Hm)	Deflection (d) should not exceed the max value of deflection (d*) (d<d*) [d*= 10.36 mm]	Eco-friendly



*If you are in a team of 5, please copy and paste the above on a new page

MILESTONE 3A (STAGE 3) – MATERIAL SELECTION: MATERIAL ALTERNATIVES AND FINAL SELECTION

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Consolidation of Individual Material Rankings					
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
	Material Name	Material Name	Material Name	Material Name	Material Name
Yield Strength(GPa)	Low Alloy Steel	Tungsten Alloys	CFRP, epoxy matrix (isotopic)	Titanium Alloys	Stainless Steel
Yield Strength(GPa)/Density (Kg/m^3)	Stainless steel	Low carbon steel	High carbon steel	Medium carbon steel	Aluminum alloy
*Youngs Mod/ Density * CO2*	Stainless Steel	Copper Alloys	Zinc Alloy	Low Alloy Steel	Medium Carbon Steel
Yield Strength/(p*Hm)	Stainless Steel	High Carbon steel	Medium Carbon steel	Low alloy Steel	Low Carbon steel

Narrowing Material Candidate List to 3 Finalists	
Material Finalist 1:	Stainless Steel
Material Finalist 2:	Low Alloy Steel
Material Finalist 3:	Medium Carbon Steel

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Compare Material Alternatives and Make a Final Selection using a Decision Matrix

→ As a team, establish a weighting factor for each criterion:

- Move row-by-row
  - If *Criteria 1* is preferred over *Criteria 2*, assign a 1. Otherwise, assign 0
  - If *Criteria 1* is preferred over *Criteria 3*, assign a 1. Otherwise, assign 0
- Add additional rows/columns as needed

Criteria Ranking						
	Lightweight	*Compatibility*	*Easy Installation*	Safety	Efficiency	**Weight factor**
Lightweight	1	0	0	0	0	1
Compatibility	1	1	1	0	0	3
Easy Installation	1	0	1	0	0	2
Safety	1	1	1	1	0	4
Efficiency	1	1	1	1	1	5

→ As a team, evaluate your materials against each criterion using your weighting

- Add additional rows as needed

Decision Matrix							
		Stainless Steel		*Low Alloy Steel*		*Medium Carbon Steel*	
	Weight factor	Rating (1-5)	Weighted Rating	Rating (1-5)	Weighted Rating	Rating (1-5)	Weighted Rating
Efficiency	5	4	**20**	5	**25**	5	**25**
Safety	4	3	**12**	5	**20**	4	**16**
Compatibility	3	4	**12**	3	**9**	2	**6**
Easy Installation	2	3	**6**	5	**10**	4	**8**
Lightweight	1	2	**2**	4	**2**	3	**3**
TOTAL			**52**		**66**		**58**

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→ List your chosen material and justify your selection

Justification	
List Chosen Material:	Low Alloy Steel

Low allow steel:

Density: Low average density when compared to stainless Streel, but it was relatively the same when compared the medium Carbon Steel.

Strength: During the overall rating of the decision matrix, low alloy steel and medium carbon steel had an edge over stainless steel in terms of efficiency when compared to the young's modus of each material. However, in comparison with the other criteria assessed, low alloy steel has the edge over medium carbon steel.

Carbon footprint: Low Alloy Steel has the lowest Carbon footprint out of Stainless Steel and Medium Carbon Steel

Summary of Chosen Material's Properties

Material Name: Low alloy steel	Average value:
Young's modulus E (GPa):	205 GPa
Yield Strength σ_y (MPa):	1035 MPa
Tensile strength σ_{UTS} (MPa):	1250 MPa
Density ρ (kg/m^3):	7800 kg/m^3
Embodiment Energy H_m (MJ/kg)	31.1 MJ/kg
Specific carbon footprint CO_2 (kg/kg)	2.49 kg/kg