PROJECT ONE: MILESTONE 3A – COVER PAGE

Team Number: Mon-31

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

Full Name:	MacID:
Avery Thurston	thurstoa
Kavi Gurunathan	gurunatk
Gurleen Dhillon	dhillg25
Olutayo Oluwasegun	olutayoo

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.

EWB Humanitarian Aid Mission

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	Minimize cost	$E/\rho C_m$	$\sigma_y/\rho C_m$	Minimize cost because it is for a local village who might not have enough money to produce expensive turbines.
Secondary	Minimize production energy	$E/\rho H_m$	$\sigma_y/\rho H_m$	Minimize production energy to make is easier for villagers to make more wind turbines.

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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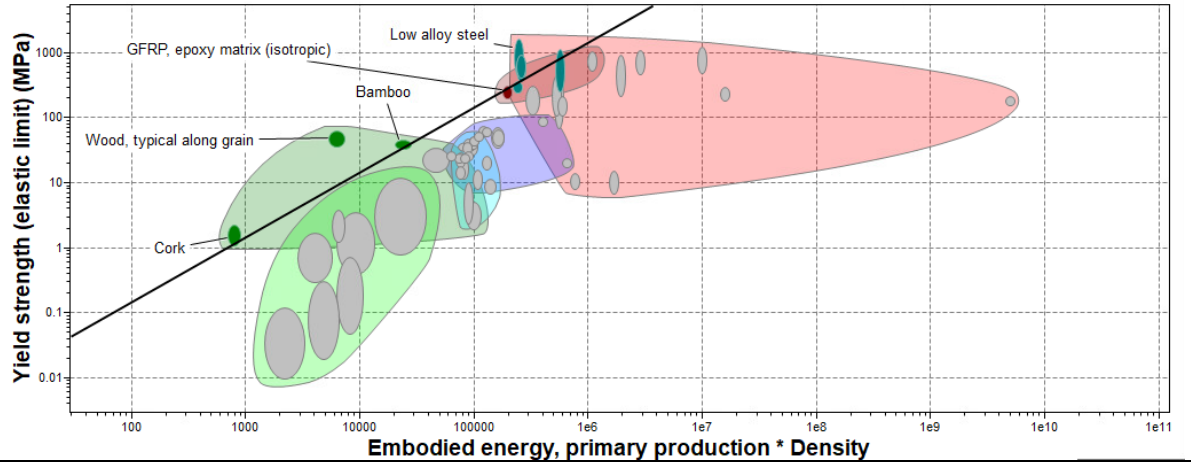
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Gurleen Dhillon	dhillg25

Material Property Chart

Assigned MPI #1	Functional Constraint	Objective
$\sigma_y/\rho H_m$	The deflection d must be less than some value d* (d<d*)	Minimize production energy

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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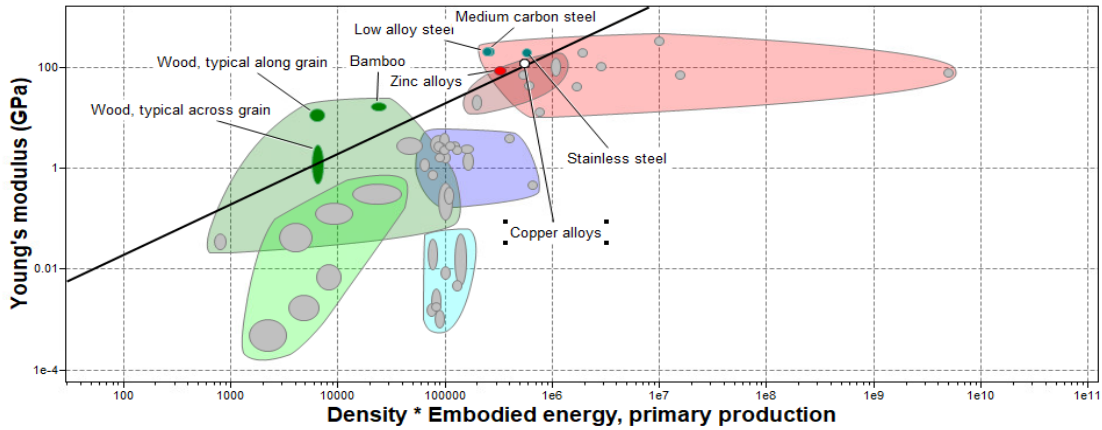
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Olutayo Oluwasegun	olutayoo

Material Property Chart

Assigned MPI #2	Functional Constraint	Objective
$E/\rho H_m$	The deflection d must be less than some values d*(d<d*)	Minimize production energy

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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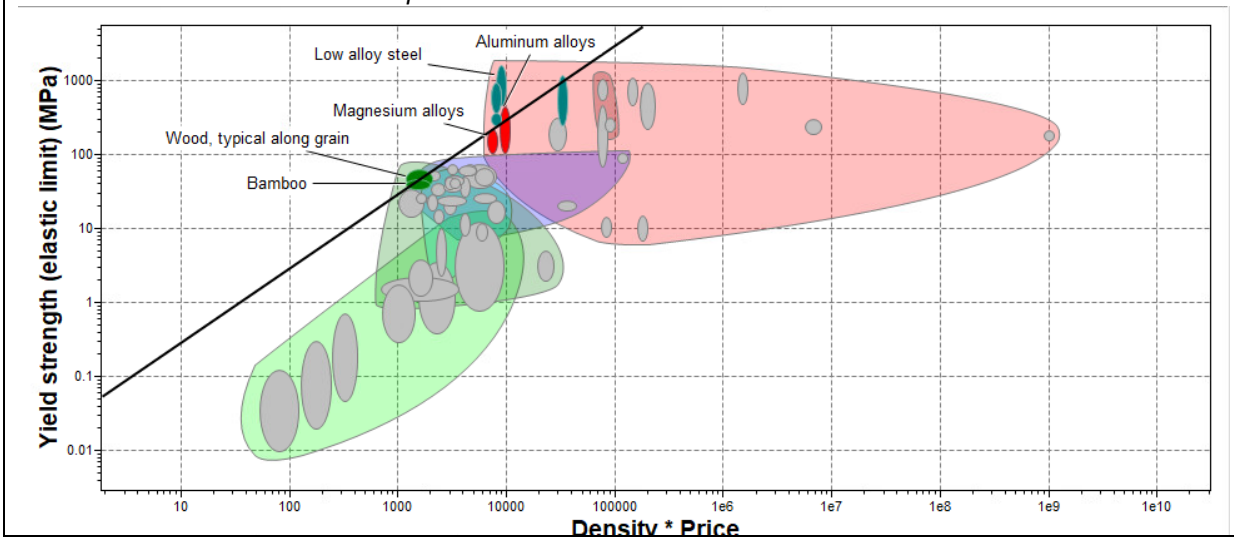
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Avery Thurston	thurstoa

Material Property Chart

Assigned MPI #3	Functional Constraint	Objective
$\sigma_y/\rho C_m$	The deflection d must be less than some value d* (d<d*)	Minimize Cost

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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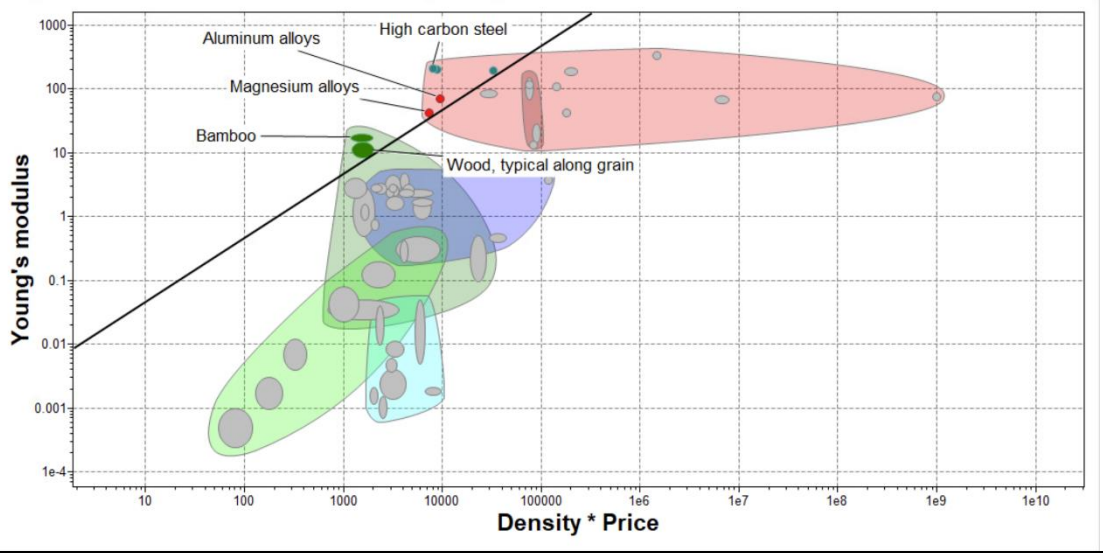
Copy-and-paste from the INDIVIDUAL worksheet

Full Name:	MacID:
Kavi Gurunathan	gurunatk

Material Property Chart		
Assigned MPI #4	**Functional Constraint**	**Objective**
$E/\rho C_m$	The deflection d must be less than some value d* ($d<d^*$)	Minimize cost

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



*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
$\sigma_y/\rho H_m$	Wood, typical along grain	low alloy steel	cork	bamboo	GFRP, epoxy matrix (isotropic)
$E/\rho C_m$	High carbon steel	Bamboo	Aluminum alloy	Wood, typical along grain	Magnesium alloy
$\sigma y/\rho C_m$	Low Alloy Steel	Wood, typical along grain	Bamboo	Aluminium Alloys	Magnesium Alloys
$E/\rho H_m$	Wood, typical along grain	Low carbon steel	Bamboo	Zinc alloys	Copper alloys

Narrowing Material Candidate List to 3 Finalists	
Material Finalist 1:	Wood, typical along grain
Material Finalist 2:	Bamboo
Material Finalist 3:	Low Alloy 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	*Durable*	*Easy to repair*	Accessibility	**Weight factor**
Lightweight	1	0	0	0	1
Durable	1	1	1	1	4
Easy to repair	1	0	1	0	2
Accessibility	1	0	1	1	3

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

- Add additional rows as needed

Decision Matrix							
	Weight factor	*Wood, typical along grain*		*Bamboo*		*Low alloy steel*	
		Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
Lightweight	1	3	**3**	5	**5**	2	**2**
Durable	4	3	**12**	2	**8**	5	**20**
Easy to repair	2	2	**4**	2	**4**	4	**8**
Accessibility	3	5	**15**	4	**12**	2	**6**
TOTAL			**34**		**29**		**36**

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→ List your chosen material and justify your selection

Justification	
List Chosen Material:	Low alloy steel
Discuss and justify your selection in the space below (based on the MPIs and any other relevant considerations). This material is the most durable out of all the materials, and it is also easier to fix. This means the wind turbines can be used for a long time, reducing the long-term cost for the villagers. Bamboo and wood may be more accessible, but they are not good materials to use in the long run when compared to low alloy steel, because they are more likely to be damaged (I.e. by weather) thus leading to unavoidable expenses.	

Summary of Chosen Material's Properties

Material Name:	Average value:
Young's modulus E (GPa):	205
Yield Strength σ_y (MPa):	1,034.5
Tensile strength σ_{UTS} (MPa):	1,249.5
Density ρ (kg/m^3):	7,800
Embodiment Energy H_m (MJ/kg)	31.05
Specific carbon footprint CO_2 (kg/kg)	2.49