

MILESTONE 4 (STAGE 1) – FINALIZED DESIGN: ESTIMATE THICKNESS REQUIREMENT

Estimate the deflection of the turbine blade on the following page

→ Each team member is required to complete this worksheet

During the Design Studio, we will be asking that you copy-and-paste your individual work into the **Milestone Four Team Worksheets**. It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their estimation of deflection with the **Milestone Four Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into the **Milestone Four Team Worksheets** document allows you to readily access your team member's work
 - This will be especially helpful when completing **Stage 2** of the milestone

Team Number: 26

Full Name:	MacID:
Sana Khan	khans288

1. The title of the scenario

Engineer Without Borders

2. Chosen Material

	Material Name	Young's Modulus (GPa)	Yield Strength (MPa)
Chosen Material	High Carbon Steel	210	678.5

3. Estimate of Deflection - Analytical Model

Assigned thickness, t from Table 1 (mm)	15mm
Estimated deflection δ (mm)	14.0mm

Insert calculation or photo of hand calculation.

$$I = \frac{\pi}{4} [a^3b - (a-t)^3(b-t)] \quad \delta = \frac{P b L^4}{4 E I}$$

$$\textcircled{1} I = \frac{\pi}{4} [0.189^3 \cdot 0.375 - (0.189 - 0.015)^3 (0.375 - 0.015)]$$

$$= 4.989141577 \times 10^{-4} \text{ m}^4 \rightarrow 0.4989141577 \text{ mm}^4$$

$$\textcircled{2} \delta = \frac{(3000)(0.375)(8.5)^4}{4(2.1 \times 10^{11})(4.989141577 \times 10^{-4})}$$

$$= 0.0140 \text{ m} = 14.0 \text{ mm}$$

$P = 3000 \text{ Pa}$
 $a = 0.189 \text{ m}$
 $b = 0.375 \text{ m}$
 $L = 8.5 \text{ m}$
 $t = 0.015 \text{ m}$
 $E = 210 \text{ GPa} = 2.1 \times 10^{11} \text{ Pa}$

MILESTONE 4 (STAGE 2) – FINALIZED DESIGN: REFINE THICKNESS REQUIREMENT

Team Number: 26

Please complete this worksheet in your corresponding team document.

MILESTONE 4 (STAGE 3) – PEER INTERVIEW

Team Number:

26

Please complete this worksheet in your corresponding team document.