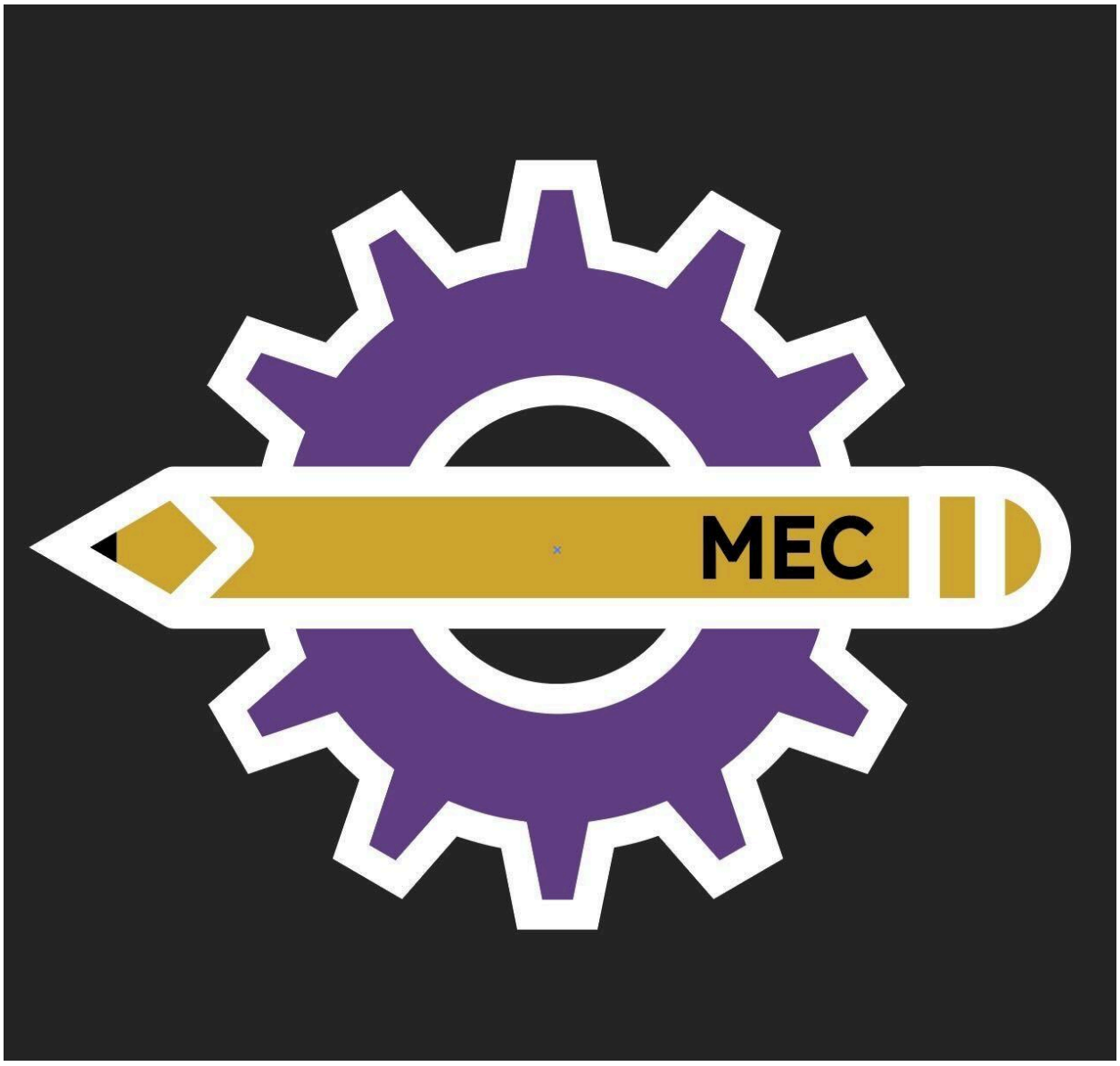

Toronto Metropolitan University

Junior Design Competition 2024: Fall

Abstract

Background:

Modern urban environments demand innovative infrastructure solutions that prioritize sustainability, safety, and reliability. Hydraulic lift bridges for pedestrians exemplify such innovation, addressing the need for efficient, safe, and eco-friendly transportation. As cities grow and waterways remain vital for commerce and recreation, integrating infrastructure that accommodates both pedestrian and maritime traffic is essential. Hydraulic lift bridges offer a dynamic solution, enhancing urban mobility while maintaining environmental integrity.

Challenge:

The objective of this challenge is to design, build, and demonstrate a hydraulic bridge that:

- Balances on two supports (textbooks) of known height (2 inches).
- Opens either with a cantilever lift or a split drawbridge mechanism to allow an object of known height to pass underneath (8 inches).
- Meets minimum size requirements for length and width (12 inches x 3 inches).
- Can stay locked in both open and closed positions.
- Can withstand loads applied at various locations along the bridge deck.

Deliverables:

- Submission of a detailed design and prototype demonstrating the hydraulic lift device mechanism and safety features.
- A comprehensive report explaining design choices, materials used, and sustainability measures.
- Visual aids to illustrate the bridge's operation, integration into the urban landscape, and energy efficiency.

Materials:

- Popsicle sticks (100x)
- Cardboard
- Straws (15x)
- Plastic syringes (5x)
- Plastic hosing (1.5 ft)
- Tape
- Glue
- Rubber bands
- Paper clips (12x small, 5x jumbo)
- Clothespin (2x)
- Sponge (1x)
- Ruler
- String (2 m)
- Cup (1x)
- Water

JUDGING CRITERIA

PROJECT		**/100**
Functionality and Precision	● Does the hydraulic system operate without jerky movements, demonstrating smooth motion and control? ● Does the bridge meet the clearance requirement, opening fully to allow the specified object to pass through the center? ● Does the bridge reach and hold a specific angle or height in the open position as required?	/30
Structural Stability and Load Capacity	● Does the bridge support a specified load without excessive deflection or failure? ● Does the bridge support loads effectively when placed at different points along the bridge deck? ● Does the bridge maintain structural integrity with minimal deformation under load?	/30
Hydraulic System and Engineering Design	● Does the bridge effectively use varying syringe sizes and tubing to create smooth, controlled motion? ● Does the design display strategic placement and sizing of syringes to maximize lift and control with minimal fluid. ● Is there evidence of overcoming design challenges with creative hydraulic solutions?	/20
Locking Mechanism Effectiveness	● Does the locking mechanism hold the bridge firmly in place under load in both open and closed positions? ● Is the locking mechanism simple to engage and release, demonstrating practical design?	/10
Aesthetics and Material Efficiency	● Is there evidence of the team demonstrating effort in overall visual design, creativity, and the finish of the bridge's appearance? ● Is there effective use of provided materials without unnecessary waste or overuse?	/10
PRESENTATION		**/30**

Visual Aids	/5
Design Process, Justification and Critique	/10
Voice, Articulation and Timing	/10
Response to Questions	/5
TOTAL	**/130**

Point Penalties	
Plagiarism	Elimination
Insufficient citation	-50
Documents received after deadline	-50
Absent team member	-25
Entering presentation room before allotted time (after first offense)	-10
Design is based off of an impossible concept	-50
Design makes no attempt to solve the problem within the constraints of the problem statement	-50
Total	