



# Exodia'20

## Crane-o-mania

**TASK:** Design a Tower Crane using popsicle sticks cotton strings and Fevicol as adhesive (without using any strengthening coating) that can sustain the maximum possible load with optimum radius and self-weight, satisfying all the understated constraints.

**(Note: Participants will be disqualified if any of the below parameters are not followed)**

### **Design Constraints:**

1.The Tower Crane should be **stationary** and will not be fixed to the ground by any means.

The base area of the crane should not exceed **20cm x 20cm** in plane.

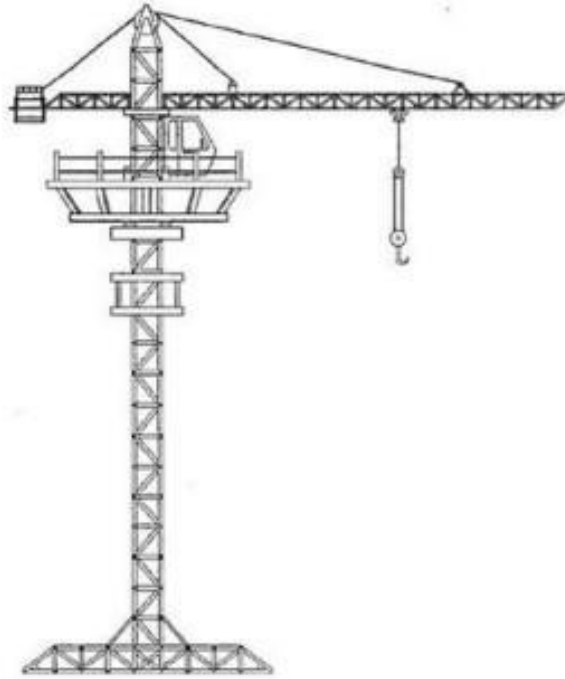
2.The boom can be flexible in terms of height and operating radius. (This is not compulsory but this provision will have an advantage in final rating)

3.Counter weight provision is allowed in any case the Base area should not be exceeded than the permissible mentioned in point 1. Crane should not be anchored to the ground.

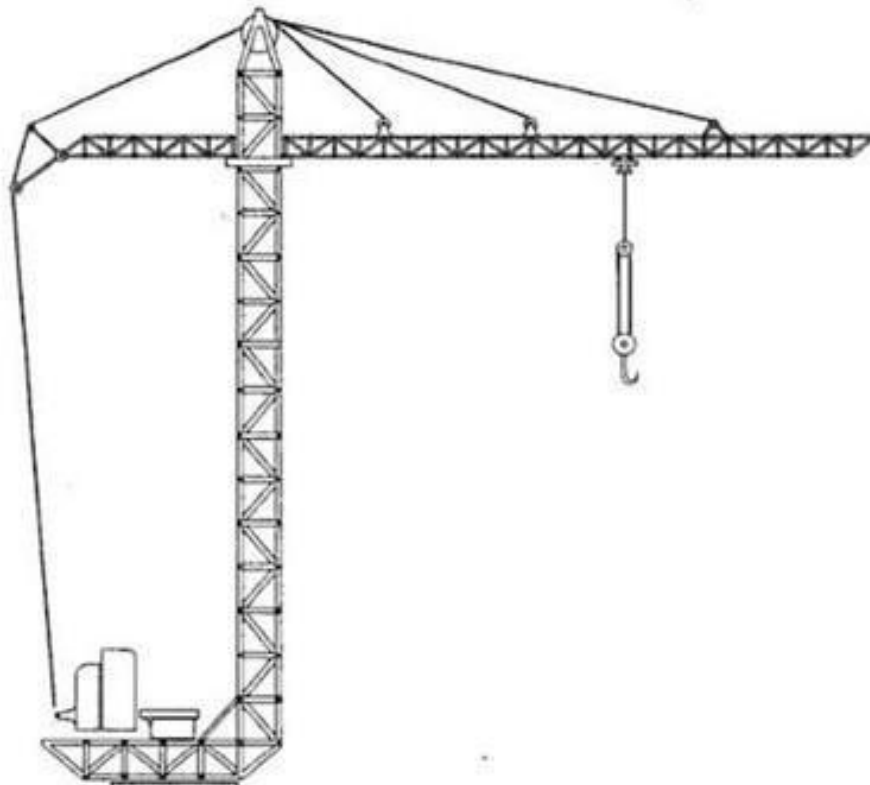
4.A pulley arrangement with a thread should be prepared as shown in fig. 1 for application of load.

5.The crane can be made with a rotation mechanism in plan to allow for 360 degree angle of operation. (This is not compulsory but this provision will have an advantage in rating)

(Note: The Designs shown given below are just examples, you can come with your own design given that it follows all the Design constraints)

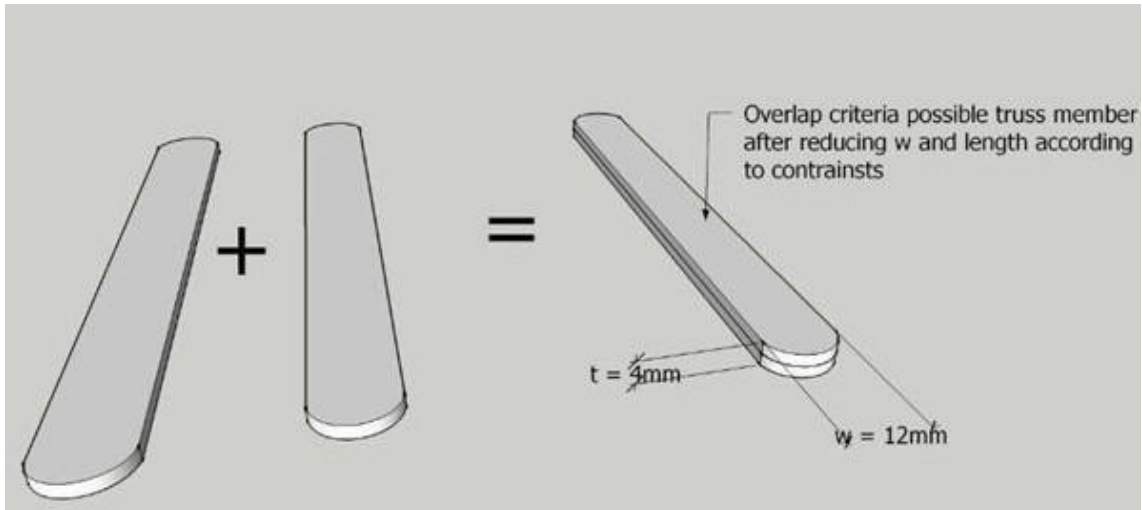


**FIG. 1** (The base should not be fixed, use counterweights to balance)



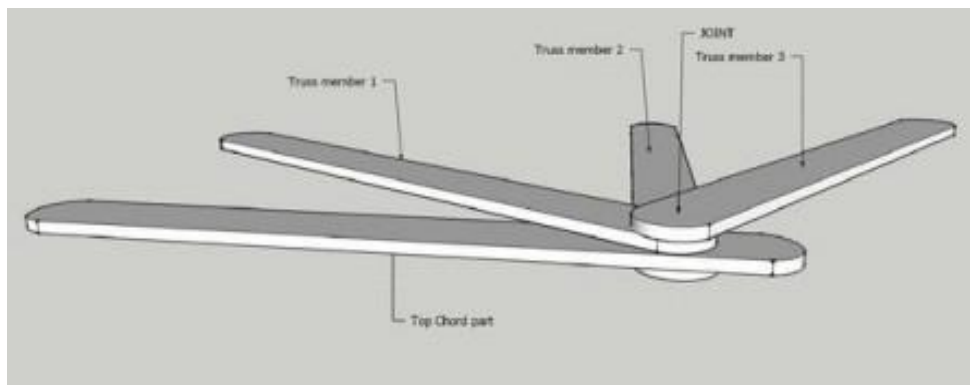
**FIG 2**

**6. Overlap criteria** for truss members - Not more than two Popsicle sticks should be overlapped longitudinally to make a truss member i.e. the **maximum thickness(t)** of a truss member should be **5mm** and **maximum width(w)** is **12mm** as shown below.



7. **Joint criteria** for Truss Members - Joints should resemble a pin connection i.e. all ends of members should meet exactly at a point which is the joint and **not more than 8** Popsicle sticks should be overlapped at joints as shown below

**Loading will be done at the end point of boom of the crane, so drill a circular hole of 10mm diameter at the center (in the end) for placing the hook.**



**Materials Used:**

Strictly adhere to the following materials:

1. Popsicle sticks (maximum length 120 mm, width 12 mm and thickness 2 mm) and **Fevicol MR White adhesive** should only be used to build the structure . The Popsicle sticks can be cut or trimmed to any shape or size.
2. White colored Cotton threads should be used for the cables.
3. Adhesive can only be used to join Popsicle sticks together; Adhesives cannot be applied on the free **surface of a member made of Popsicle sticks to increase its strength**
4. If rotation is provided it shall be **created from scratch**. No readymade bearings are allowed for rotation. For e.g. as seen below a CD stack can form an example of a rotation pin wherein metal balls can be added in between the CDS to make a bearing mechanism.
5. Counter-weight can be used anything, but it should not support the structure in any way other than balancing.



### **Cable:**

Each Cable made of a single thick cotton thread or a group of thin cotton threads. The maximum **diameter of the cable should be strictly less than 1mm**. The cable can be attached to the crane by tying it around the Crane directly or by making a hole in the Popsicle sticks carefully while building the crane for assistance in tying as shown. The cable can be attached to the top chord or the top of the truss members again either by tying around the member or by making holes in the popsicle sticks making the top cord of the crane

### **Gameplay:**

#### **Testing:**

1. Teams will be given 5 minutes to make final changes in their structure before the testing, and once the changes are done, the structure will be weighed. After weighing is done no changes can be made in the structure.
2. The dimensions of the structure will be measured.
3. All construction and material requirements will be checked prior to testing. **Cranes failing to meet these requirements and constraints will be disqualified or penalized accordingly.**
4. Loading will be done using a hook at the end of the Crane. The loading would be done on the crane using a 5cm x 10cm loading plate-connecting hook system. For this the bridge should have a **10 mm diameter circular hole.**

(**Note:** The loading mechanism might change according to the circumstances during the competition but the mechanism won't affect the results.)

#### **Definition of failure:**

The structure is considered failed when any of the following happens:

1. The loading machine registers maximum load or the structure fails to follow any of the mentioned constraints.
2. Vertical Deflection of the end of the crane exceeds 40mm.

**General Rules:**

1. Once the structure is weighed, you are not allowed to modify your structure in any way.
2. If any of these constraints are not met, point deductions (as mentioned) or disqualification may be imposed at the sole discretion of the organizers.
3. Any team that is not ready at the time specified will be disqualified immediately.

**4. Judges' decision shall be final and binding on all.**

**5. The organizers reserve all rights to change any or all of the above rules as they deem fit.**

6. Change in rules, if any will be highlighted on the website and will be mailed to all the registered participants.

**Team Specifications:**

A team may consist of a maximum of 4 members. Students from any branch or year can form a team.

**Judging Criteria:**

The judging of the structure is based on 3 important criteria:

1. Self-weight of the Crane (SW) in kg
2. Counter-weight used (CW)
3. Radius of boom (R) in mm
4. Load carried by the structure before failure (L) Judging will be based on the following formulas:

$$1) \quad A = \frac{\text{(Load * Operating radius)}}{\text{Total Weight of Crane}}$$

$$2) \quad B = \text{Aesthetics}$$

$$3) \quad P = \text{Penalties (Points to be deducted for same will be decided by the judges)}$$

$$\text{Total Score} = A + B - P$$

**Eligibility**

All students with any branch year or institute are eligible to participate in this competition at **EXODIA 2K20.**

## **Compliance**

At check-in, event organizers will evaluate each structure. Structures will be weighed, measured, and reviewed for compliance with rules regarding materials. If a structure doesn't comply with any of the following rules.

1. Structures that are completed but do not meet the construction guidelines will be given a chance to make any necessary alterations.
2. No alterations will be allowed unless deemed necessary by the Judges. The decisions of the organizers are final.

**Registration fee : 500 Rs.**

**For any query feel free to contact:**

**ANKIT GUPTA (6388792413)**  
Abhishek Gautam(9997227942)

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