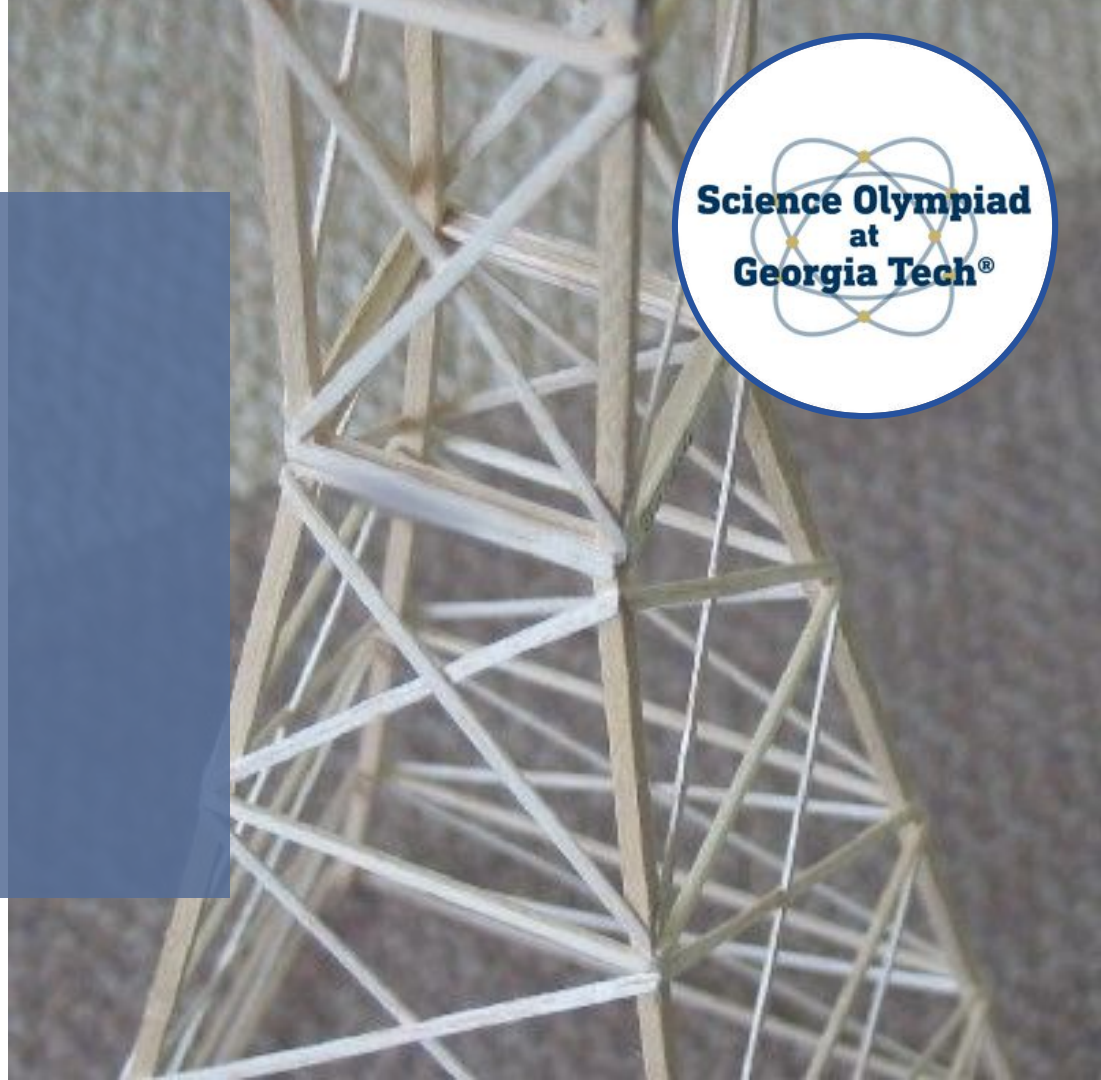
Tower

Division B/C

Georgia Tech Event Workshop Series
2024-25



01 RULES SHEET

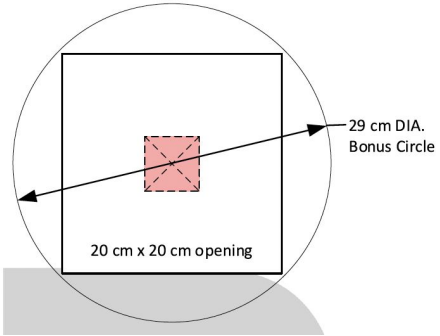
02 DIFFICULT TOPICS

03 TIPS FROM A VETERAN

04 OTHER FREE RESOURCES

The Rules Sheet

- Dimension (50cm tall)



- Bonus point
- Scoring
- Make sure not to get tier down
- During competition

Div B rule

iv. The portion of the Tower more than 25.0 cm above the Test Base must pass through an 8.0 cm ring gauge (5.g.).

TOWER B

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Teams will design and build a Tower (Structure) constructed of wood, bonded by adhesive, spanning a 20 cm square opening, able to support the loading block at least 50 cm above the test base and allow an 8 cm diameter ring gauge to pass over the top of the tower and lowered down to a point 25 cm above the test base. Bonuses can be obtained by holding 15 kg and spanning a 29 cm circle (rather than the 20 cm square). The structure must meet the requirements specified in these rules to achieve the highest score, which is a combination of structural efficiency and bonus.

A TEAM OF UP TO: 2 **EYE PROTECTION:** B
IMPOUND: No **EVENT TIME:** 6 minutes

2. **EVENT PARAMETERS:**
   a. Each team is allowed to enter only one Structure, built prior to the competition.
   b. All participants must properly wear eye protection at all times (reference Eye Protection Policy found on www.soinc.org). Teams without proper eye protection will be immediately informed and given a chance to obtain eye protection if time allows. Participants not wearing proper eye protection will not be allowed to compete and be placed in Tier 3.
   c. Participants may NOT bring any equipment such as levels or squares.
   d. The Event Supervisor will provide all Test Apparatus (see Section 5) and tools/materials/ring gauge for measurement except for virtual tournaments, the teams must supply all Test Apparatus that fully meets the requirements of Section 5, any deviations from Section 5 will be scored as a construction violation for the team.
3. **CONSTRUCTION PARAMETERS:**
   a. The Structure must be a single assembly with no separate, loose, sliding, or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
      i. Wood is defined as the hard, fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include bark, particleboard, wood composites, bamboo or grasses, paper, commercially laminated wood (i.e., plywood), or members formed of sawdust, wood shavings, and adhesive. Wood may never be painted, soaked, or coated in glue, color enhanced, or have tape/preprinted/paper labels affixed. Ink barcodes and/or markings from the construction process may be left on the wood.
      ii. There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
      iii. Adhesive is a substance used to join two or more materials together and may be used only for this purpose. Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane, and super glues). Adhesive tapes are not allowed.
   b. Structure design requirements:
      i. Must span a 20 cm x 20 cm opening on a Test Base (5.a.).
      ii. May be placed on the Test Base surface in any orientation such that the loading chain is suspended within 2.5 cm of the center of the opening in the Test Base.
      iii. Must support the Loading Block (5.b.i.) a minimum of 50.0 cm above the Test Base. There is no maximum Tower height.
      iv. The portion of the Tower more than 25.0 cm above the Test Base must pass through an 8.0 cm ring gauge (5.g.).
      v. The loading point on the Structure must be constructed to permit placement of the Loading Block (5.b.i.) on the Tower and constructed such that only the Loading Block (5.b.i.) supports the chain and bucket.
      vi. **Bonus Points** (6.c.) can be obtained by designing the Tower to span a 29 cm diameter circle, centered on the 20 cm x 20 cm opening of the Test Base and holding 15.0 kg.
   c. Participants must be able to answer questions regarding the design, construction, and operation of the structure per the Building Policy found on www.soinc.org.

4. **THE COMPETITION:**

Part I: Check-In
   a. The team must present their Structure for inspection & measurement.
   b. The team must place their Structure on the Structure Scale (5.e.) so the Event Supervisor or Assistant can determine the mass, in grams, to the nearest 0.01 g or best precision available.
   c. The team will measure the Structure height and demonstrate that the ring gauge (5.g.) can be placed over the tower and lowered to a height of 25 cm or less above the Test Base using provided measurement tools so the Event Supervisor or Assistant can determine if the Tower meets the requirements. Measurements shall be in cm to the nearest 0.1 cm.
   d. The team must submit their Estimated Load Supported (6.e.i.) to be used as a tiebreaker.
   e. No alterations, substitutions, or repairs may be made to the Structure once the check-in process has started.
   f. Prior to Part II: Testing: the Event Supervisor will verify that the combined mass of the Loading Assembly with empty bucket does not exceed 1,500 g.
   g. Prior to Part II: Testing: the Event Supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g, but no more than 15,200 g.

Part II: Testing
   a. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
   b. Participants will have 6 minutes to set up and test their Structure to maximum load or failure.
   c. The participants must place the Structure on the Test Base and assemble the Loading Block Assembly and bucket as required to load the Structure. If necessary, participants may disassemble the Loading Block Assembly but must re-assemble in the same order as presented by the Event Supervisor. The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Structure to deflect.
   d. The participants will be allowed to adjust the Structure until they start loading sand. Once loading of sand has begun, the Structure must not be further adjusted.
   e. The Event Supervisor will check that the loading chain is suspended within 2.5 cm of the center of the opening in the Test Base before loading begins.
   f. The Event Supervisor before testing will verify no part of the Tower's span touches or is supported within the 29 cm diameter circle for the Tower to qualify for the "Load Scored Bonus".
   g. Participants will load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by participants is NOT allowed. The bucket may only be stabilized by using the tips of the provided Bucket Stabilizing Sticks (5.d.).
   h. Loading stops immediately when Structure failure occurs, or time expires. Structure Failure is defined as the inability of the Structure to carry any additional load, or if any part of the load is supported by anything other than the Structure. Incidental contact of the chain/eyebolt with the structure is not a failure. At the Supervisor's discretion, sand may be removed from the bucket if pouring continued after the structure fails or time expires.
   i. Once loading stops, any parts of the Structure in the bucket will be removed. The Load Supported (mass of the Loading Assembly and the sand in the bucket) will be recorded to the nearest gram or best precision available. The minimum Load Supported is the mass of the Loading Assembly. The maximum Load Supported is 15,000 g.
   j. At the Event Supervisor's discretion, more than one Test Apparatus may be used.
   k. The Event Supervisor will review with the team the data recorded on their scoresheet.
   l. Teams who wish to file an appeal must leave their structure with the Event Supervisor.

TOWER C

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION**: Teams will design and build a Tower (Structure) constructed of wood, bonded by adhesive, spanning a 20 cm square opening, able to support the loading block at least 50 cm above the test base with only 3 points of contact with the Test Base. Bonuses can be obtained by holding 15 kg and spanning a 29 cm circle (rather than the 20 cm square). The structure must meet the requirements specified in these rules to achieve the highest score, which is a combination of structural efficiency and bonus.

A TEAM OF UP TO: 2 **IMPOUND:** No

EYE PROTECTION: B **EVENT TIME:** 6 minutes

2. **EVENT PARAMETERS:**
   a. Each team is allowed to enter only one Structure, built prior to the competition.
   b. All participants must properly wear eye protection at all times (reference Eye Protection Policy found on www.soinc.org). Teams without proper eye protection will be immediately informed and given a chance to obtain eye protection if time allows. Participants not wearing proper eye protection will not be allowed to compete and be placed in Tier 3.
   c. Participants may NOT bring any equipment such as levels or squares.
   d. The Event Supervisor will provide all Test Apparatus (see Section 5) and tools/materials for measurement except for virtual tournaments, the teams must supply all Test Apparatus that fully meets the requirements of Section 5, any deviations from Section 5 will be scored as a construction violation for the team.
3. **CONSTRUCTION PARAMETERS:**
   a. The Structure must be a single assembly with no separate, loose, sliding, or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
      i. Wood is defined as the hard, fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include bark, particleboard, wood composites, bamboo or grasses, paper, commercially laminated wood (i.e., plywood), or members formed of sawdust, wood shavings, and adhesive. Wood may never be painted, soaked, or coated in glue, color enhanced, or have tape/preprinted/paper labels affixed. Ink barcodes and/or markings from the construction process may be left on the wood.
      ii. There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
      iii. Adhesive is a substance used to join two or more materials together and may be used only for this purpose. Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane, and super glues). Adhesive tapes are not allowed.
   b. Structure design requirements:
      i. Must span a 20 cm x 20 cm opening on a Test Base (5.a.).
      ii. May only have 3 points of contact with the Test Base (5.a.) and each tower leg must be in its own quadrant, not shared with any other leg.
      iii. Must be placed on the Test Base surface such that the loading chain is suspended within 2.5 cm of the center of the opening in the Test Base.
      iv. Must support the Loading Block (5.b.i.) a minimum of 50.0 cm above the Test Base. There is no maximum Tower height.
      v. The loading point on the Structure must be constructed to permit placement of the Loading Block (5.b.i.) on the tower and constructed such that only the Loading Block (5.b.i.) supports the chain and bucket.
      vi. **Bonus Points** (6.c.) can be obtained by designing the Tower to span a 29 cm diameter circle, centered on the 20 cm x 20 cm opening of the Test Base and holding 15.0 kg.
   c. Participants must be able to answer questions regarding the design, construction, and operation of the structure per the Building Policy found on www.soinc.org.
4. **THE COMPETITION:**

Part I: Check-In

   a. The team must present their Structure for inspection & measurement.
   b. The team must place their Structure on the Structure Scale (5.e.) so the Event Supervisor or Assistant can determine the mass, in grams, to the nearest 0.01 g or best precision available.
   c. The team will measure the Structure height using provided materials so the Event Supervisor or Assistant can determine if it meets or exceeds the minimum height (3.b.iv.) in cm to the nearest 0.1 cm.

TOWER C (CONT.)

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

   d. The team must submit their Estimated Load Supported (6.e.i.) to be used as a tiebreaker.
   e. No alterations, substitutions, or repairs may be made to the Structure once the check-in process has started.
   f. Prior to Part II: Testing: the Event Supervisor will verify that the combined mass of the Loading Assembly with empty bucket does not exceed 1,500 g.
   g. Prior to Part II: Testing: the Event Supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g, but no more than 15,200 g.

Part II: Testing

   a. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
   b. Participants will have 6 minutes to set up and test their Structure to maximum load or failure.
   c. The participants must place the Structure on the Test Base and assemble the Loading Block Assembly and bucket as required to load the Structure. If necessary, participants may disassemble the Loading Block Assembly but must re-assemble in the same order as presented by the Event Supervisor. The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Structure to deflect.
   d. The participants will be allowed to adjust the Structure until they start loading sand. Once loading of sand has begun, the Structure must not be further adjusted.
   e. The Event Supervisor will check that the loading chain is suspended within 2.5 cm of the center of the opening in the Test Base before loading begins.
   f. The Event Supervisor before testing will verify:
      i. The Tower only has 3 points of contact with the Test Base and each tower leg must be in its own quadrant, not shared with any other leg.
      ii. That no part of the Tower's span touches or is supported within the 29 cm diameter circle for the Tower to qualify for the "Load Scored Bonus".
   g. Participants will load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by participants is NOT allowed. The bucket may only be stabilized by using the tips of the provided Bucket Stabilizing Sticks (5.d.).
   h. Loading stops immediately when Structure failure occurs, or time expires. Structure Failure is defined as the inability of the Structure to carry any additional load, or if any part of the load is supported by anything other than the Structure. Incidental contact of the chain/eyebolt with the structure is not a failure. At the Supervisor's discretion, sand may be removed from the bucket if pouring continued after the structure fails or time expires.
   i. Once loading stops, any parts of the Structure in the bucket will be removed. The Load Supported (mass of the Loading Assembly and the sand in the bucket) will be recorded to the nearest gram or best precision available. The minimum Load Supported is the mass of the Loading Assembly. The maximum Load Supported is 15,000 g.
   j. At the Event Supervisor's discretion, more than one Test Apparatus may be used.
   k. The Event Supervisor will review with the team the data recorded on their scoresheet.
   l. Teams who wish to file an appeal must leave their structure with the Event Supervisor.

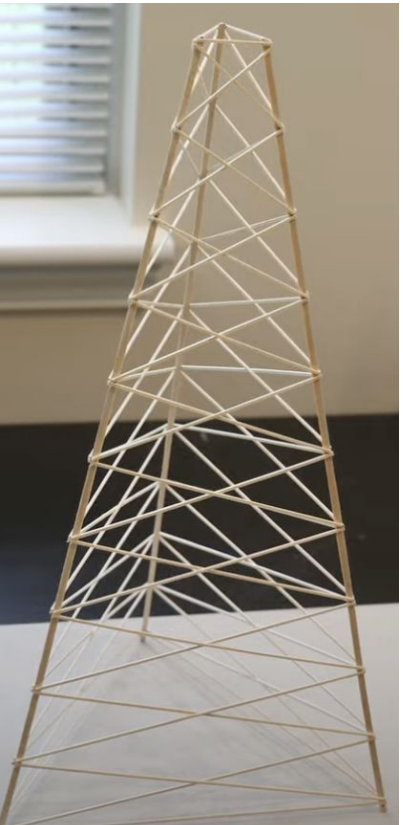
5. **TEST APPARATUS:**
   a. The Test Base shall be a solid, level surface as follows:
      i. At least 55.0 cm long x 32.0 cm wide, stiff enough that it does not bend noticeably when loaded.
      ii. Shall have a smooth, hard surface (e.g., metal, high-pressure plastic laminate).
      iii. Shall have an opening at its center approximately 20.0 cm x 20.0 cm.
      iv. Shall have a 29 cm circle drawn on the surface, centered on the 20 cm x 20 cm square opening. The surface outside the 29 cm circle shall be the Load Scored Bonus Zone.
      v. Shall be divided into 4 quadrants by drawing lines on the Test Base that extend from the corners of the 20 cm x 20 cm opening to the edge of the Test Base at 45 degrees as shown in Diagram 1.

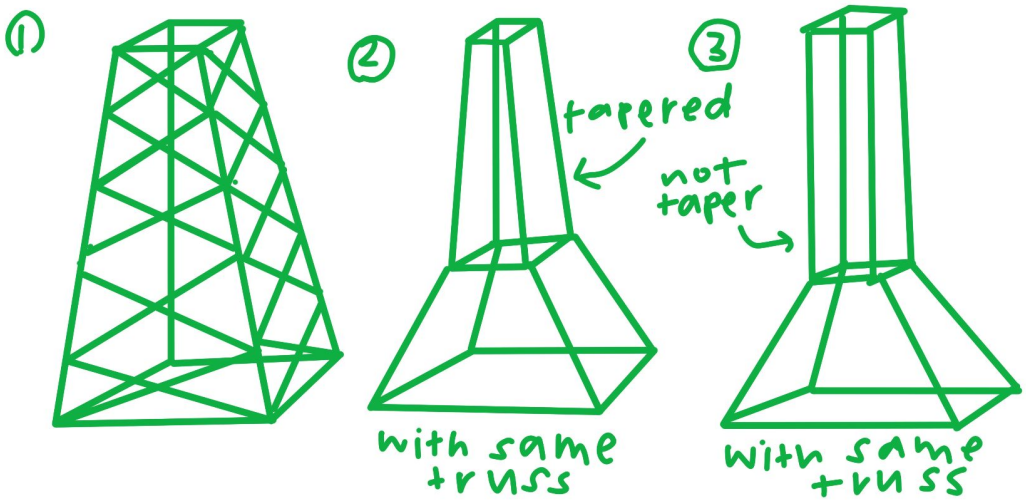
Scoring

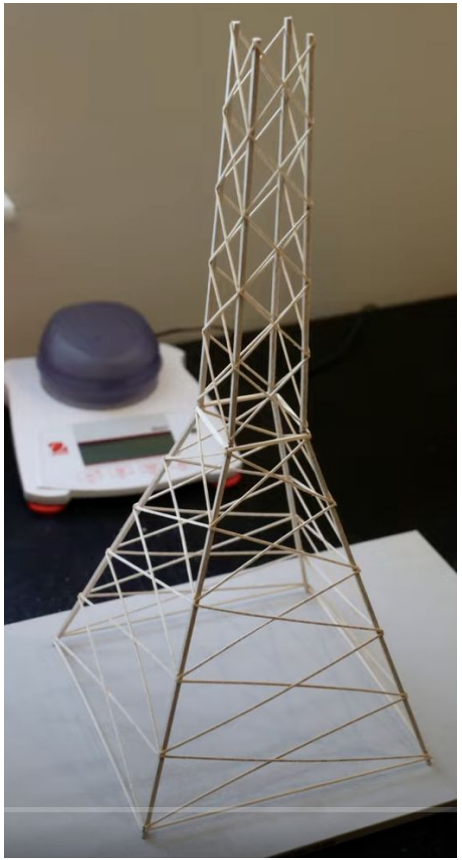
6. **SCORING:**
   a. High score wins. Score = [Load Score (g)/Mass of Structure (g)]
   b. The Load Score= Load Supported (4.II.i) + Load Scored Bonus (6.c.).
   c. Load Scored Bonus: Structures that ONLY contact the Test Base outside the 29 cm circle and holding 15.0 kg will earn a Bonus of 5,000 g.
   d. Structures will be placed in three tiers as follows:
      i. Tier 1: Holding any load and meeting all construction parameters and competition requirements.
      ii. Tier 2: Holding any load with any violations of the construction parameters and/or competition. For virtual meets, Test Apparatus not meeting requirements.
      iii. Tier 3: Unable to be loaded for any reason (e.g., cannot accommodate or hold Loading Assembly, failure to wear eye protection) and will be ranked by lowest mass.
   e. Ties are broken as follows:
      i. Estimated Load Supported closest to, without exceeding, the actual Load Supported
      ii. Lowest Structure mass
   f. Example score calculations:
      i. Structure 1: mass= 10.12 g, Load Supported= 12,134 g; No Load Scored Bonus = 1,199
      ii. Structure 2: mass= 10.12 g, Load Supported= 15,000 g + 5,000 g Load Scored Bonus = 1,976


DIFFICULT
TOPICS

Topic 1: how to design/shape

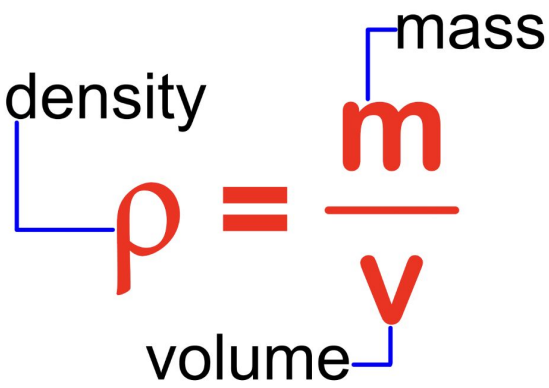


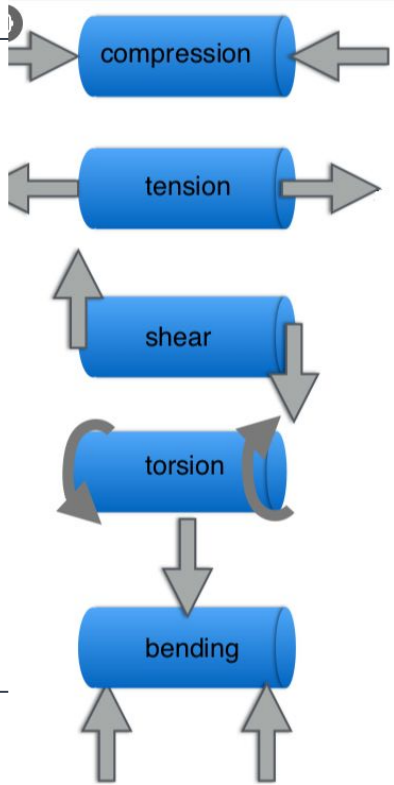


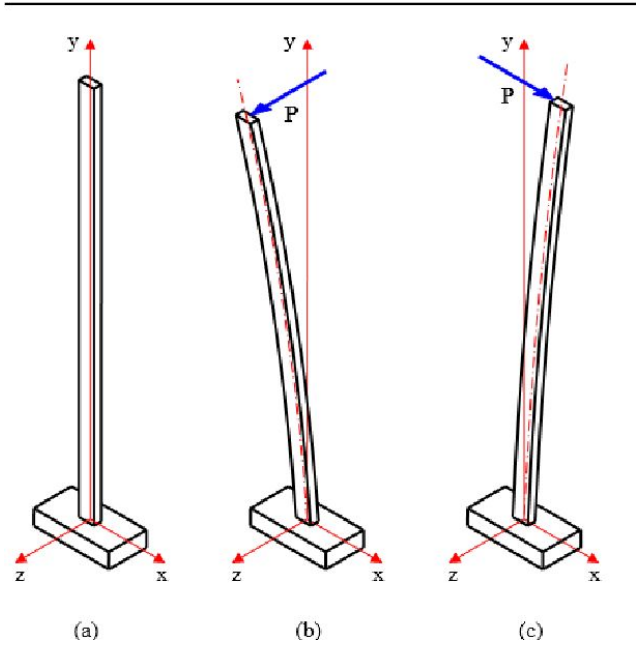


Topic 1: force act on each members

- Density
- Force

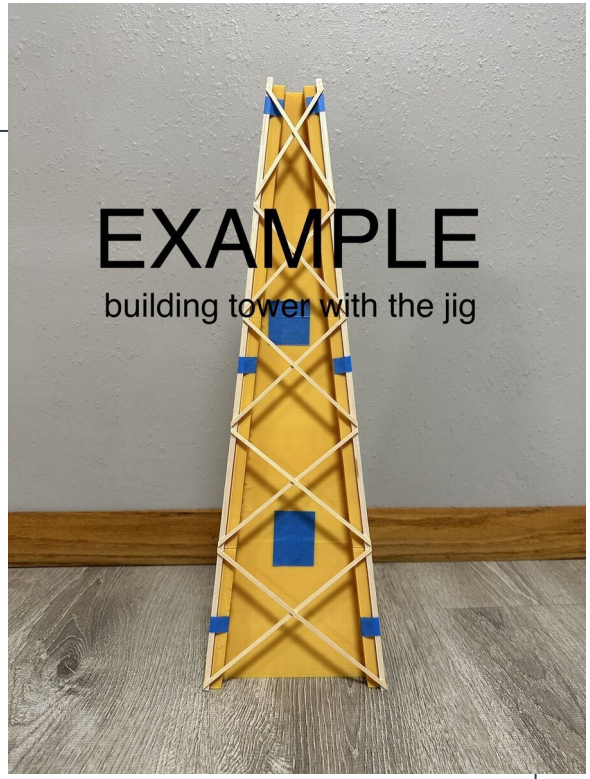






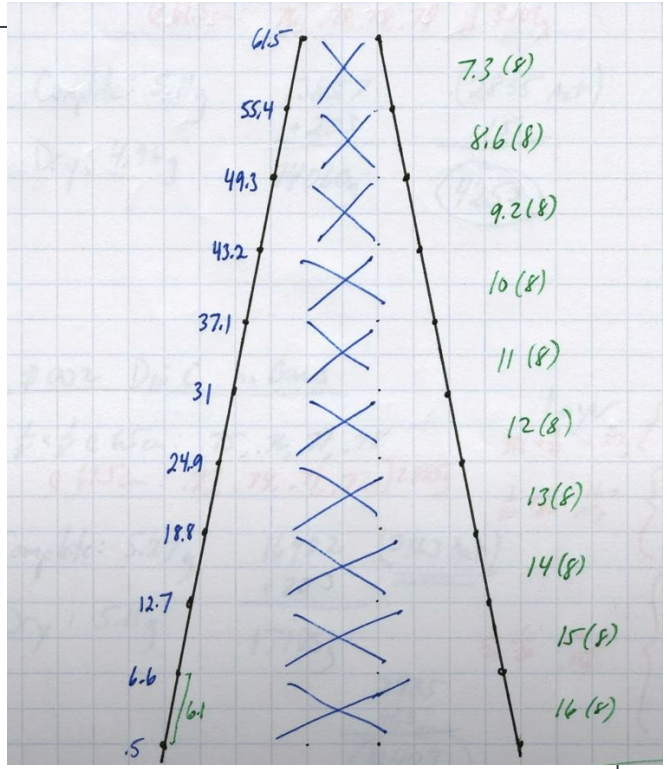
Topic 2: [craftsmanship]

- Consistency
- Glue
- Wood
- jig



Topic 3: [data collection]

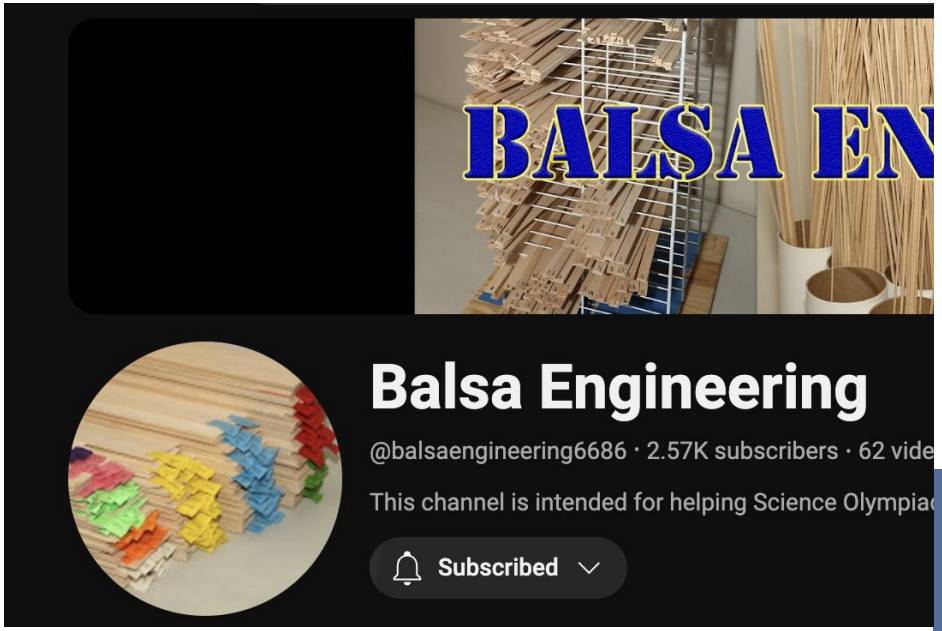
- Log
- Measure
- video(slow motion)



Tips from a Veteran

- Observe during competition
- Learn from mistake
- Build a lot and test a lot with well documentation

Additional Resources



link

THANKS!