Imperial College London

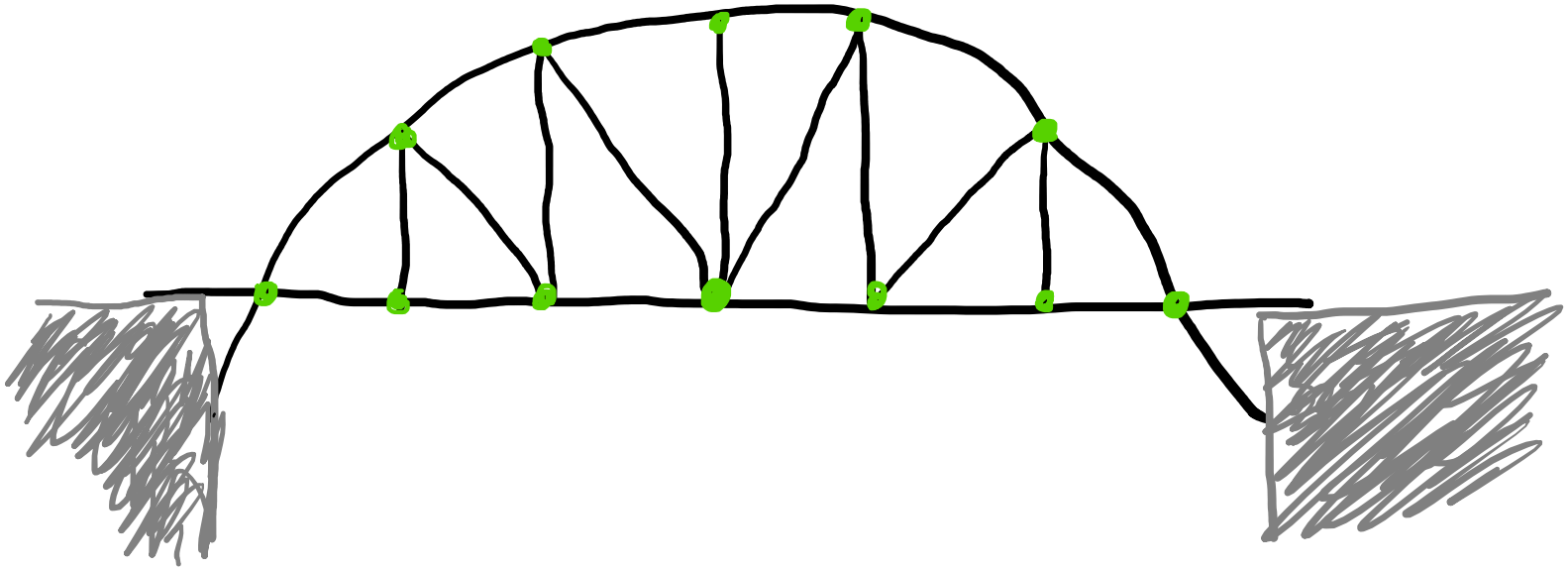
Newspaper Engineering

Strength in Geometry

Activity

Imperial College London

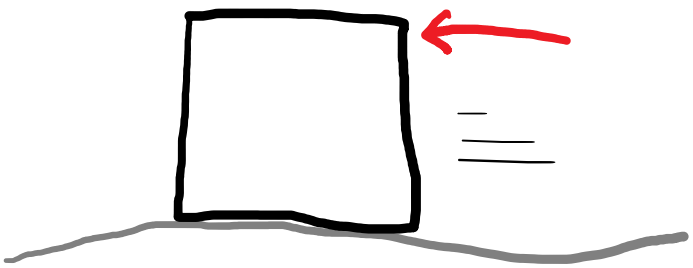
- Build a bridge from newspaper
  - How?

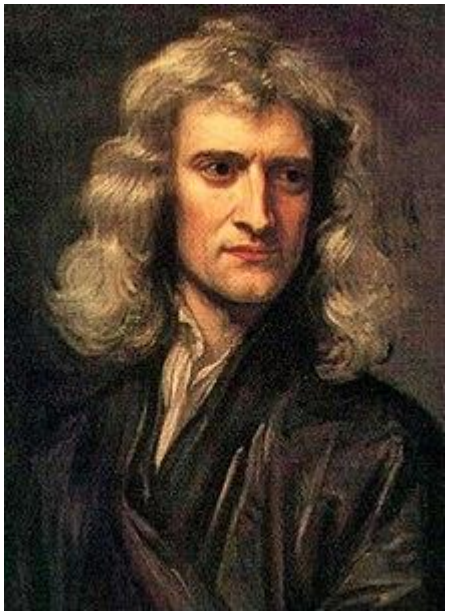


Sir Isaac Newton (1642 – 1726)

Imperial College London

- Knighted Scientist
- Lived to 84 years of age
- Father of classical mechanics
  - How forces influence the state of a body
  - Who uses this?

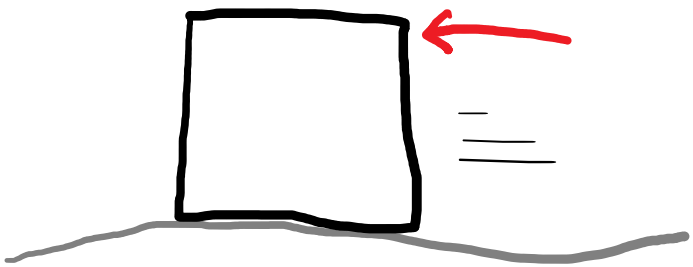




Laws of Motion

Imperial College London

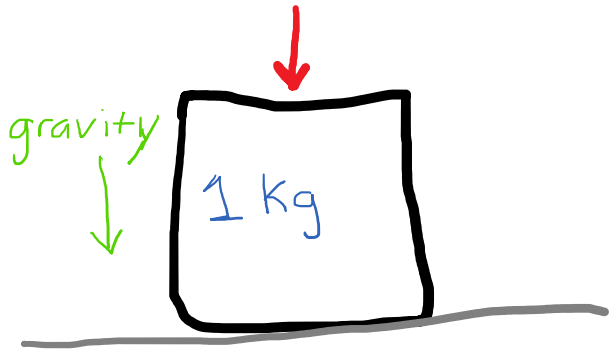
1. A body at rest remains at rest unless acted upon by a force.



Laws of Motion

Imperial College London

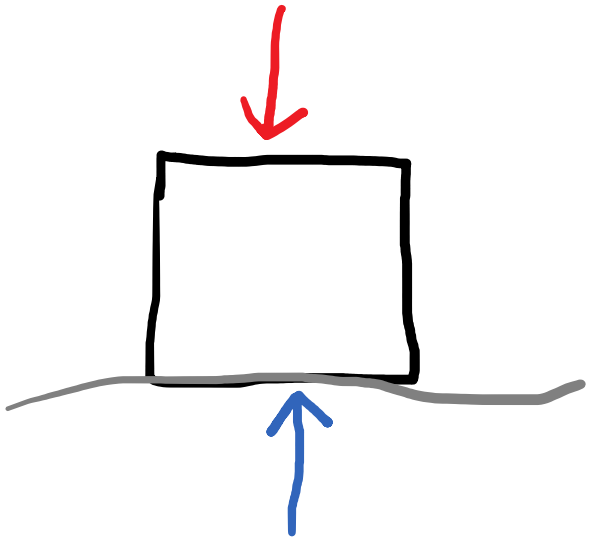
1. A body at rest remains at rest unless acted upon by a force.
2. Force = mass X acceleration



Laws of Motion

Imperial College London

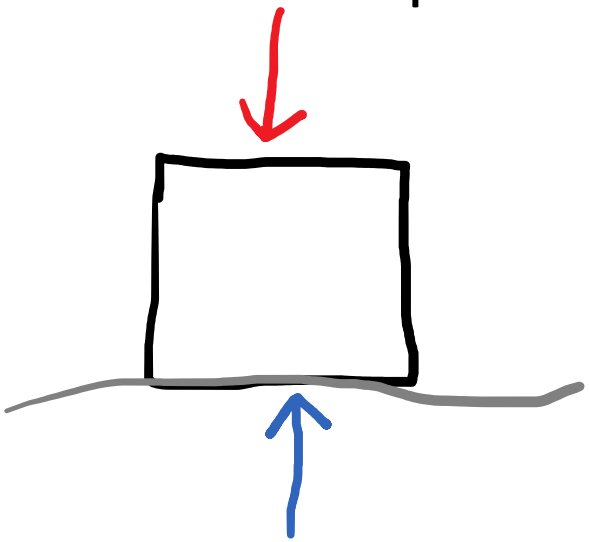
1. A body at rest remains at rest unless acted upon by a force.
2. force = mass X acceleration
3. For every force there is an equal and opposite reaction force.



Laws of Motion

Imperial College London

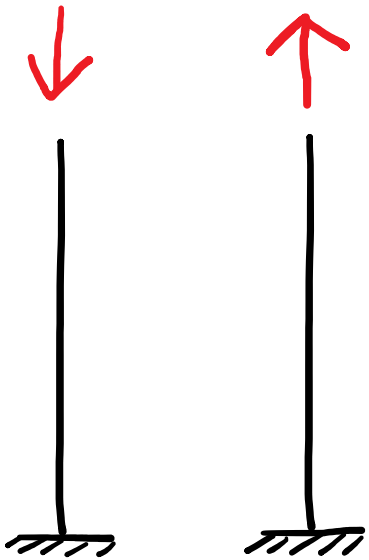
1. A body at rest remains at rest unless acted upon by a force.
2. force = mass X acceleration
3. For every force there is an equal and opposite reaction force.
4. Forces can be added up like vectors



Statics 1

Imperial College London

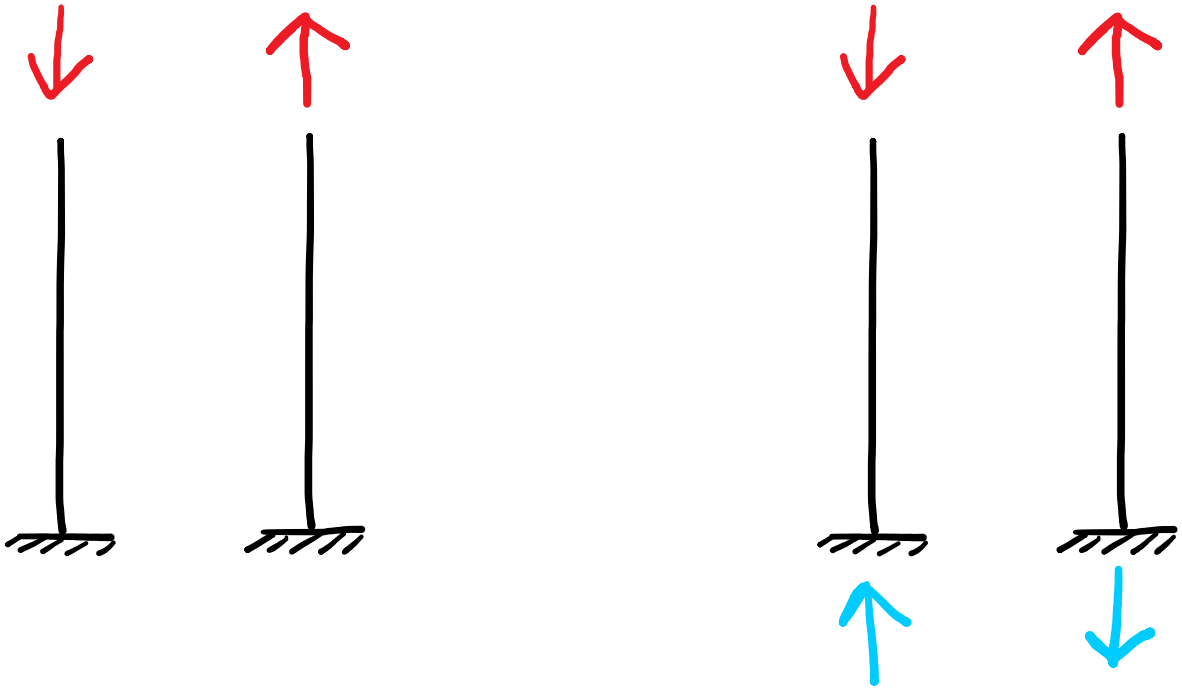
- Applied force (red arrow)
- What is the ground reaction force?



Statics 1

Imperial College London

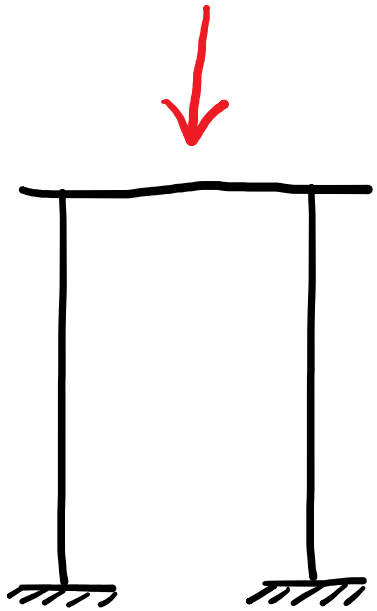
- Applied force (red arrow)
- What is the ground reaction force?



Statics 2

Imperial College London

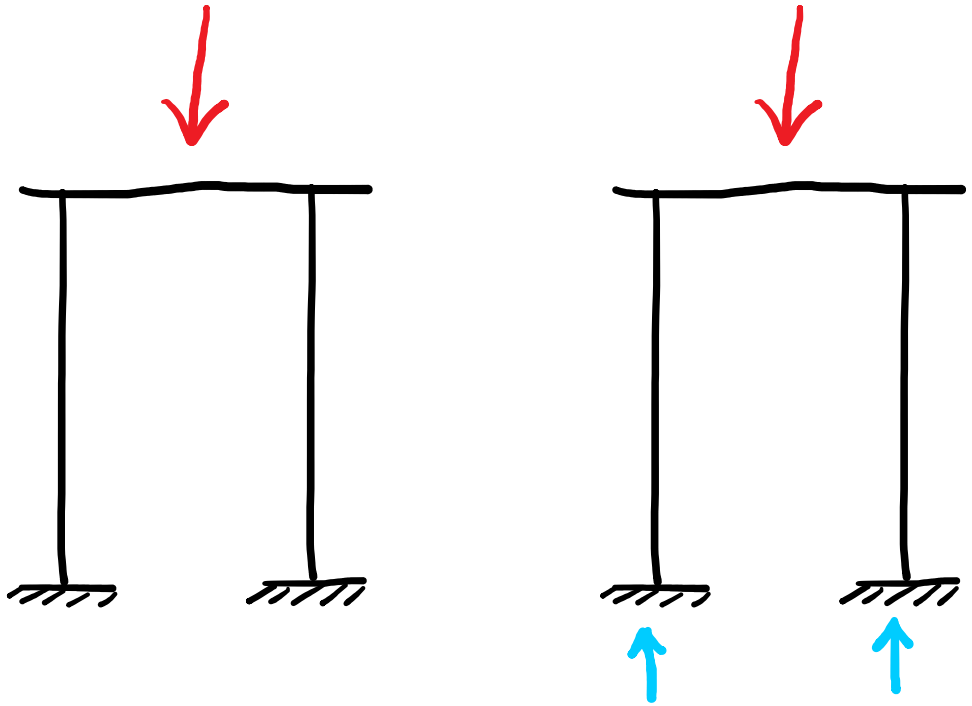
- Applied force (red arrow)
- What column supports more load?



Statics 2

Imperial College London

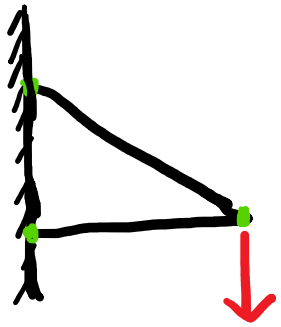
- Applied force (red arrow)
- What column supports more load?

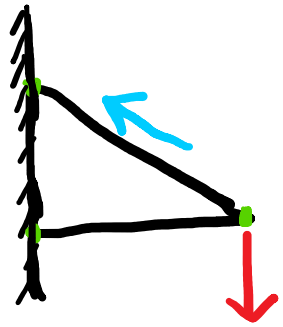


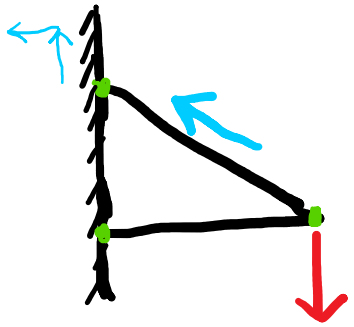
Statics 3

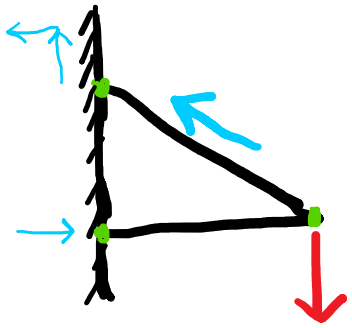
Imperial College London

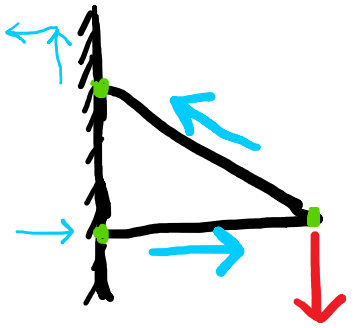
- Applied force (red arrow)
  - Only consider tension (pull) and compression (push)
- Sum of forces = 0, forces add like vectors







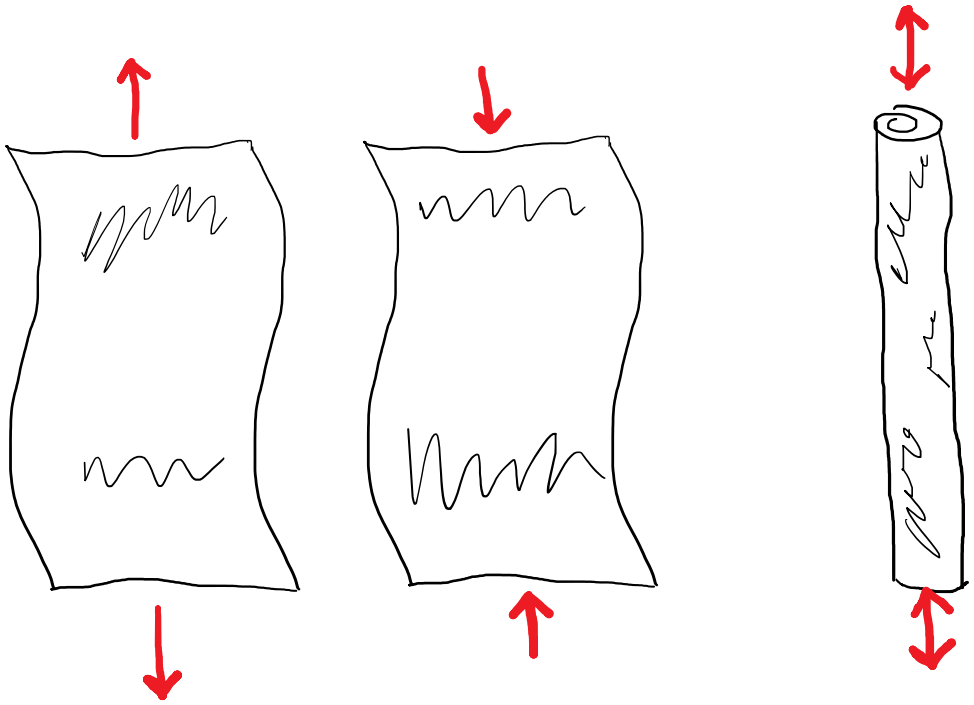




STIXX

Imperial College London

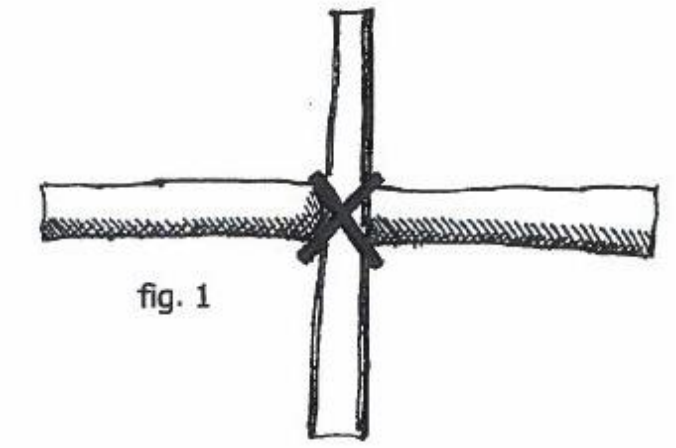
- Paper is strong in tension
  - Weak in compression
- Tightly rolled newspaper
  - Limits the tendency of thin sheets to buckle and bend

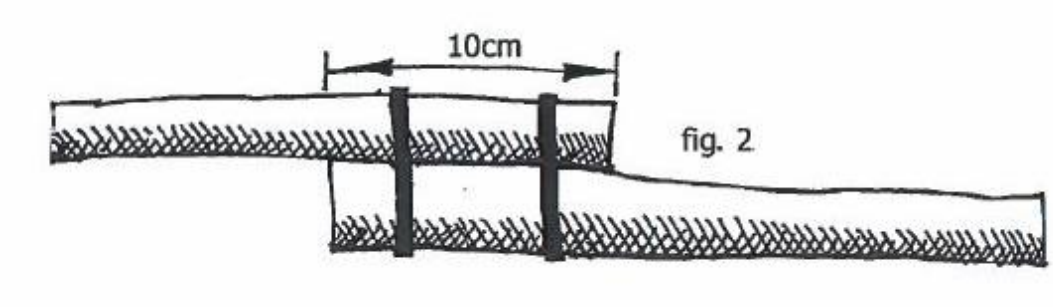


Attaching STIXX

Imperial College London

1. Ends of STIXX are soft (avoid using zip ties there)
2. Tying STIXX together 2 at a time (don't bundle)
3. Criss cross ties to increase strength and rigidity
4. To make STIXX longer – overlap and use 2+ zip ties

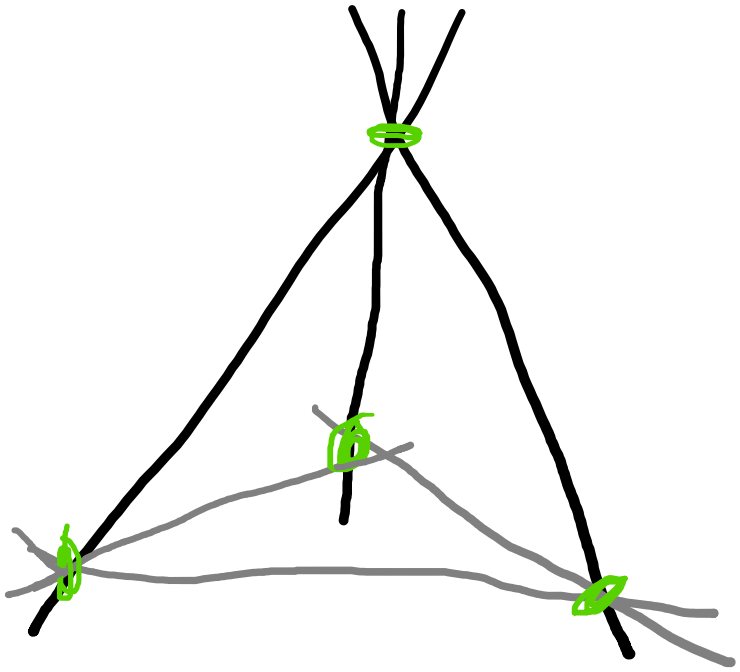




Activity 1 – Tripod

Imperial College London

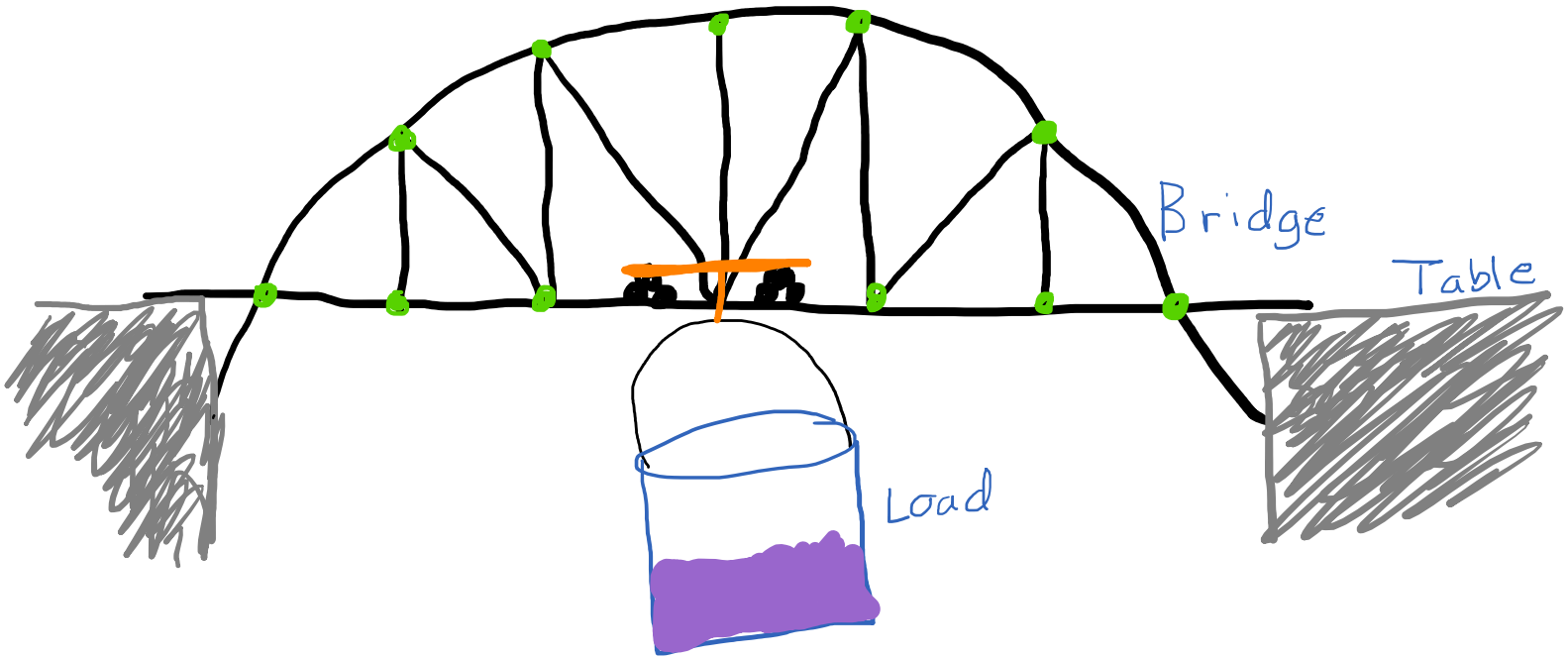
1. Split into teams of 4
2. Decide on a team name
3. Build a tripod
   - STIXX
   - Cable ties



Activity 2 – Bridge Competition

Imperial College London

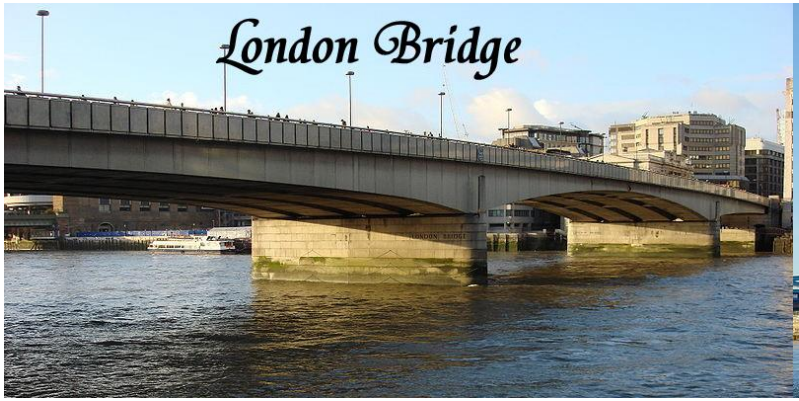
- Materials: STIXX, cable ties
  - Ask mentors to do any cutting



Bridge Competition Challenges

Imperial College London

1. Load Density Award
    1. Load density = load / # STIXX (more load, fewer STIXX)
2. Bill of Materials (BOM) Award
    1. Top 1/3 of all designs
    2. Best estimate for number of STIXX and cable ties
3. Design Award



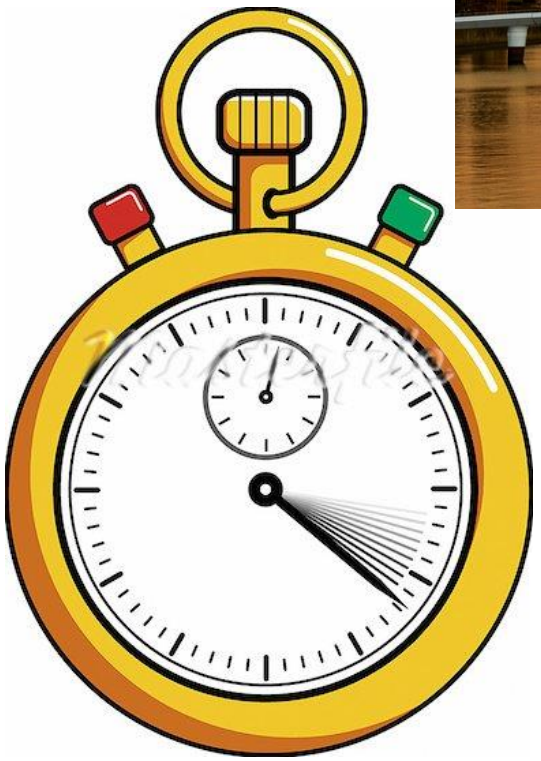
Design (10 minutes)

Imperial College London

1. Sketch your design
2. Estimate number of STIXX
3. Estimate number of cable ties

Build!

Imperial College London



- 1415 (2:15 pm) no more building