Balsa Basics and Boomilever

(slides available after clinic)

Agenda

How many folks are B? C?

- Event Overview
- Examples
- Scoring
- Building / Tools
- Testing Apparatus / Testing
- Competitions / Transportation
- Sourcing Materials

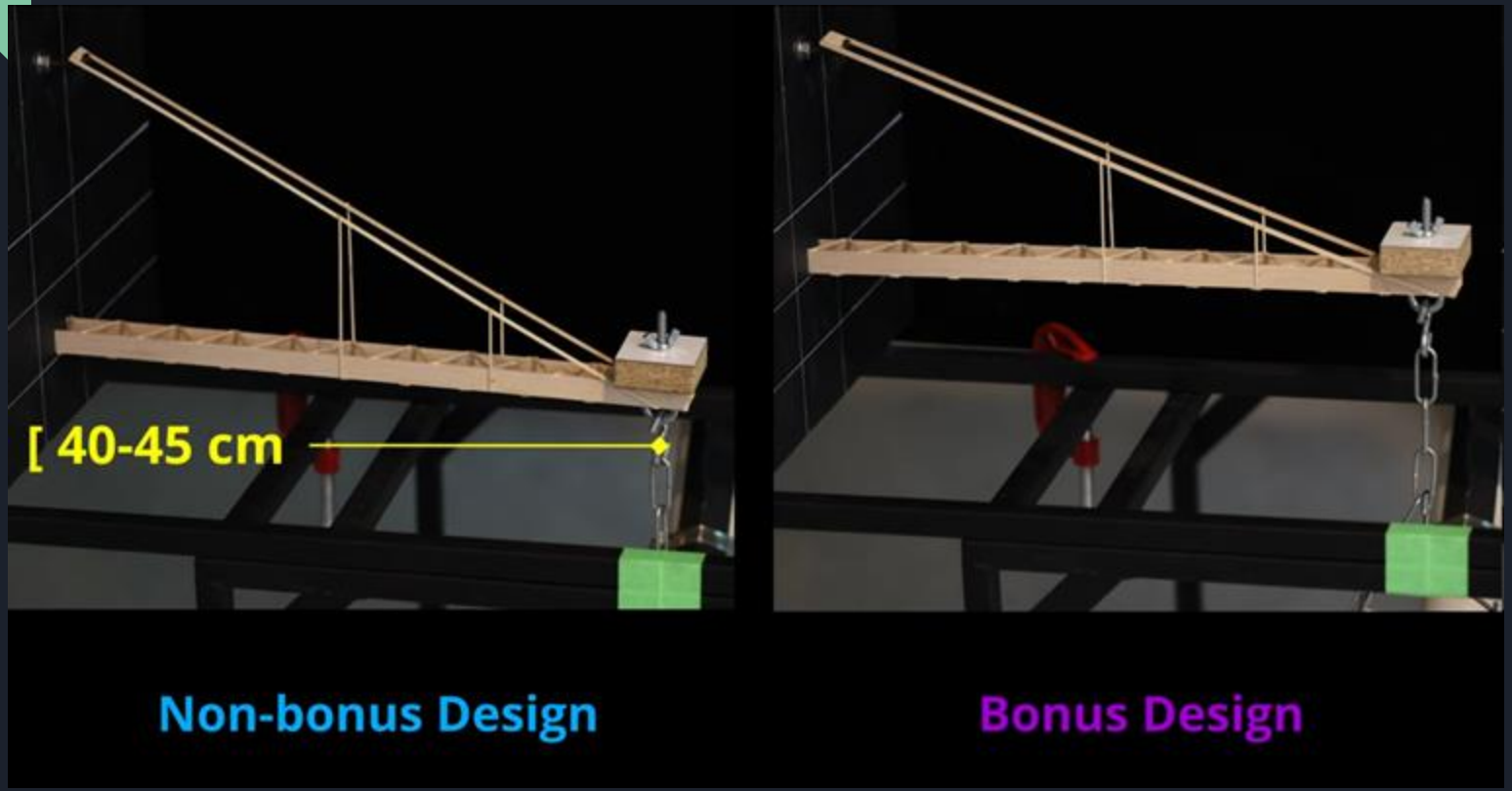
Event Overview

Students will design and build a cantilevered beam or truss structure suspended from a wall attempting to hold up to 15kg of sand – highest load:boomi ratio wins.

Notes

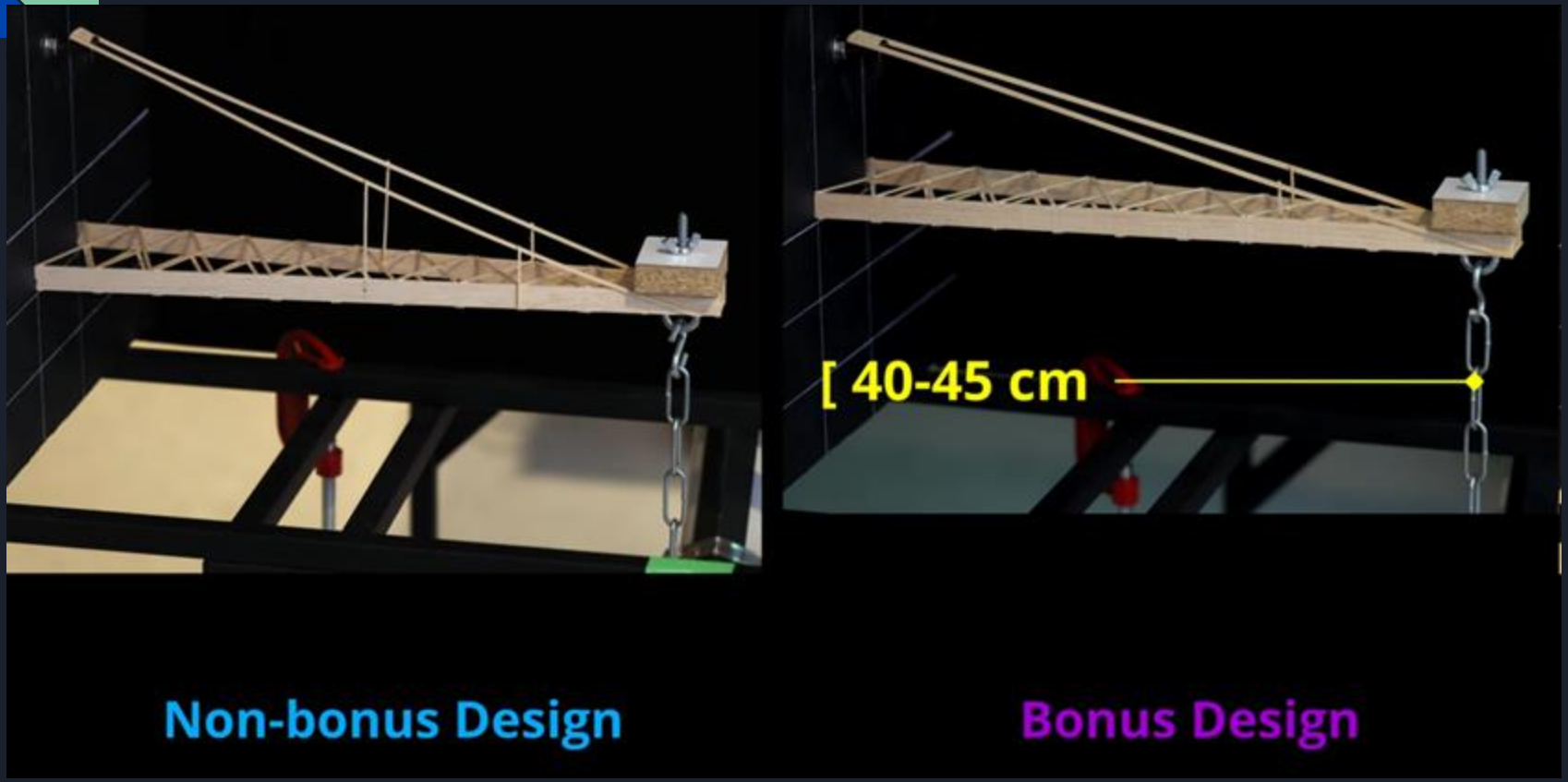
- Call it “Boomi” if you want to be one of the cool kids
- Bonuses are available for both B and C, but are they worth the risk?
- Watch all of Balsa Engineering’s videos!
- This is one of the hardest easy events on the slate

Example (B)



B – No Bonus

Example (C)



C – No Bonus

Scoring

Load Score / Structure Mass – High Score Wins

Bonus: if Bonus construction parameters are met, and the device holds all 15kg, an extra 5000g will be added to the Load Score

Is the bonus attempt worth it? Probably not! Boomi needs to be able to support 50% more load for only 33% more points. Only do this if very confident that it will hold all 15kg!

Scoring Examples:

- non-bonus 7.5g boomi, 12000g held = 1600 score
- bonus 7.5g boomi, 10000g held = 1333 score
- non-bonus 10.0g boomi, 15000g held = 1500 score
- bonus 10.0g boomi, 15000g held (+5000g bonus) = 2000 score

Building Tips

- Materials
  - Balsa – high strength to weight ratio, good for compressive loads, can design around densities
  - Basswood – high density for tension loads
  - CA Glue – cures quickly, very light for its holding strength
- Weigh and document all components, even if it feels tedious
- Start with BE's Benchmark Builds and iterate from there
- Use jigs whenever possible for consistency
- Change one element per build iteration
- Store wood in dry, flat environment and label

Building (example)

Our team built 19 towers last year, all attempting the bonus

We had one tower that held the 15kg weight during testing, but it was broken as the team removed it from the testing apparatus

Cost was $200 in custom balsa sheets, and we had ~15% material left over

Tools

- Balsa Cutter / Saw / Razor Blades
- Balsa/Basswood Stripper ($15) / Blades
- Jewelry Scale ($12)
- Digital Calipers ($28)
- CA Glue ($65 for 450g – lasts for years and also used for Helicopter)
- Glue Applicator (toothpick, needle, pin, etc)
- Painter's Tape
- Sanding Block / Emory Board / Rotary Tool
- Ruler (metric)

Testing Apparatus

Can make a simple version with:

- Two 5 gallon buckets
- 15kg Sand
- Scoop
- Loading Block
- Chain
- S-hooks
- Bolt – ¼ -20 x 2.36 inches (60 mm) long, with a 0.66-inch (17 mm) diameter head and 0.78 inch (20 mm) unthreaded section
- Hex Nut – 1/4 – 20, 0.23-inch-thick maximum (2)
- MDF / Melamine
- Clamps

Testing Tips

Beam Mass (avg)	Ends Mass (total)	Verts Mass (total)	X Mass (total)	Compression Complete	Compression w/verts	Tension Sticks (avg)	Joint (total)	Tension Complete	Boomi Complete	Boomi Dry
2.801	0.106	0.206	1.747	7.643	NA	1.126	0.401	2.648	10.664	10.266
3.133	0.094	NA	1.095	7.616	NA	1.210	0.724	3.207	10.905	10.491
3.021	0.100	0.092	1.070	7.373	NA	1.049	0.583	2.734	10.294	9.925
3.006	0.092	NA	0.835	7.096	NA	1.060	0.570	2.730	9.927	9.573
3.302	0.095	NA	1.222	8.087	NA	1.113	0.589	2.850	11.044	10.639
3.137	0.093	0.234	1.180	7.742	8.007	1.163	0.604	2.981	11.079	10.742
2.408	0.102	0.265	0.797	5.855	6.136	0.785	0.297	1.853	8.083	7.842
2.171	0.097	0.268	0.891	5.462	5.756	0.829	0.322	2.018	7.787	7.489

- Document everything
- Use slow motion video capture (camera with ⅛ speed yields 240 FPS) and analyze frame by frame
  - Even with slow motion, it's sometimes really hard to understand what happened
- Before taking to a competition, stress test the boomi with half the expected load to find faults

Competitions / Transportation

- Transport Box
  - Use a sealed dry box with desiccant packets (taped in place)
  - Hold down loosely with painter's tape
  - Leave in the box until just before weigh-in!
  - To be super competitive, can bake in oven before putting in dry box
- Bring extra glue, balsa, and basswood for on-site repairs
- Never let an Event Supervisor touch the boomi!!

Sourcing Materials

- Balsa / Basswood
  - Specialized Balsa – can order specific densities of balsa, limited basswood
  - National Balsa
- Everything Else
  - Amazon