James Dyson Foundation Undergraduate Bursary

Outreach Activity – Sustainable Construction Materials

Sam Dixon (Self-Shaping Wooden Structures)

I ran my Outreach Activity with two other students whose projects related to the use of sustainable construction materials. We therefore had an extended time slot and split this into 3 activities. These were:

- A 20-minute introduction to Sustainable Construction Materials.
- A 20-minute discussion of the issues with plastic waste, including a demonstration of how plastic might be sorted for re-use.
- A 50-minute activity to assemble and test bricks of rammed earth.

The session was deliberately structured so that the level of activity increased throughout, and therefore that the students became more active as the day went on. I will focus in this report on the first activity, which I devised, planned and ran. Since this was the first activity, it was less active, but students were kept engaged using questions to the audience.

The talk began with a discussion of the role of a structural engineer: what do they need to think about, and what kinds of things do they design? We then talked in more detail about the carbon emissions associated with the construction industry, particularly focusing on what 'embodied carbon' was. Students were good at picking up this aspect, and had clearly talked more about the climate crisis than I had at that age.

I then talked about the use of wood as a sustainable construction material. This was an aspect of my project: I looked at the response of wood to moisture, and this was easily broadened to wood as a construction material. Students were surprised at the ubiquity of wood, particularly in high-rise projects, and this is something I wish I could have discussed further. I intend to use this as a topic for future STEM outreach that I do. Wood as a material that 'sequesters' carbon is a more challenging concept, and the term 'sequestered' was deliberately avoided. Students understood the principle of locking in carbon.

I then covered concrete as a construction material, first emphasising the scale of the global concrete industry. This was demonstrated with a graphic showing bathtubs full of concrete, being filled at the rate of global concrete production. I think this was an effective way of demonstrating concrete's enormous global scale and it got the right reaction from the audience.

I showed the students a number of structures and asked if they thought concrete was used in their construction (they all used concrete) and this also worked effectively at getting the class involved. I then discussed Rammed Earth as a way of reducing the embodied carbon

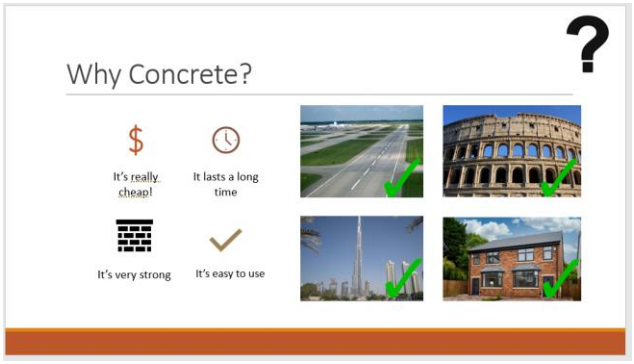
while maintaining similar properties. This pre-empted the activity later which explored rammed earth's properties mechanically. It worked well to pre-empt the material in a lecture environment, and then to follow it up with a practical workshop.

I then discussed alternative issues with sustainability via the use of Coral Bricks in some parts of the developing world. This focused on plastic bricks and their ability to replace coral bricks. Again, this pre-empted the next talk on recycling and sorting plastic.

I wrapped up with a summary slide asking the students 'What do Structural Engineers need to think about when deciding on a sustainable material?'.

I won't discuss the rest of the session (which I helped to organise and run) as they will be discussed in other people's reports. However, I'll include a couple of 'lessons learnt' that I think could be helpful to future Dyson Bursary holders:

- Audience participation with Year 9 students in an unfamiliar environment is tricky. I think confidence in delivering the session really helps to get them involved. I also started with questions that were very simple, to encourage people to get involved, and warmed everyone up with some 'raise your hand if you think ___' type questions. A summary slide where you ask the audience to recall what they have learnt worked very well **but** it does rely on a good amount of audience participation by the end of the talk.
- I used question marks on slides to indicate when I was going to seek audience participation. I sensed students were more engaged when they saw this symbol and so were more ready to answer questions.



- Using graphics to imply scale worked well and is a great way to get the audience interested.
- I would have liked to include more interactivity with the audience. However, we made a conscious choice to reduce the amount of activity at the beginning of a 1.5 hr long session and this did work well.
- Working as a team of 3 to produce a session did work well overall. However, I would point out that it is unrealistic to have 3 highly interactive sessions in this time. It is best to have an involved activity, and two shorter talks. Note that this may mean the activity is much more closely related to one person's project. Experience watching other people's sessions shows that time is often the critical factor when a complicated activity is attempted.