Interactive Activity
Climate Change CO2 Design Challenge – Bridge Building

Objectives:

- Introduce students to infrastructure's impact on climate change
- Have students contemplate how design can significantly alter the footprint of CO2
- Learn structural design principles
- Develop skills thinking about trade-off decision-making and its impact on CO2 emissions
- Great multidisciplinary engagement opportunities – design, math, science, policy

Preparation:

- Recycled materials must be chosen and collected as the "building blocks" for the challenge (we used cardboard, corrugated cardboard, toilet paper rolls, egg cartons, paper tape and hemp string)
- Containers must be provided [cardboard box] to hold material supplies
- A decision must be made as to where the materials are to come from (local, national, or international). These can be randomly assigned or you can be more purposeful in your assignment
- The excel data template may need to be altered to (i) reflect different building blocks (ii) sheets added and the summary extended to increase number of Teams who participate.
- Print off an Entry Card for each table to use (last tab in the excel workbook) to record their material use
- A remote-control car or solar powered toy car is ideal for the structural integrity test.
- The Teacher will decide whether flat cardboard and corrugated cardboard which is measured in sq. centimetres is pre labelled on the corner of each piece of flat cardboard (allows for different recycled sources such as cereal boxes, granola bar boxes, etc.), or whether students will have to do that calculation themselves when they take a piece of cardboard. If done beforehand, this is an exercise teachers can do themselves or have a group of students do.

Overview:

The challenge is to create the least carbon footprint and still create a highly aesthetic bridge. In teams, students will use recycled materials to build a bridge that can achieve two things: carry the weight of a remote control car over a distance of 1.0 meter with an elevation of 0.5 meter without collapsing, and be fashioned with the least CO2 footprint. You can add a third criteria that it must have minimal waste (maybe set this as no more than 10% of overall material use in the bridge).

Bridges will be rated at end of challenge in terms of 3 items: (1) structural integrity – strength and span (pass/fail) and (2) CO2 consumption.

Groups will design and build a bridge using the materials gathered for the project. These are each assigned different CO2 values consistent with the different types of building materials used in concrete bridges. Teams will keep track of two items: number of each material they use and where they got the item from (either local, national or international source (may wish to distribute these at different tables to make it easy for students).

Action Steps: [3 classes]

- **Step 1:** Class 1, the Teacher will outline the specifics of the challenge, the criteria and explain the material use entry cards and the materials available. Students will be placed into teams and then will have the remainder of the class to ***design*** their bridge. **[50 minutes]**

- **Step 2:** Just before Class 2, the Teacher prepares classroom for project by putting building materials on tables representing local, national or international supply centres, and having data entry cards ready for teams.

- **Step 3:** Class 2, Students will work in their team to ***build*** their bridge, using the "entry card" to track their products and whether they obtained the materials from local, national or international supply tables. After they have completed their build, they will put all unused product into their container and complete the "waste" column of their entry card. **[50 minutes]**

- **Step 4:** The teacher or dedicated student(s) will input the data from each team's "entry card" and enter into the spreadsheet to calculate the CO2 footprint of the bridge using the spreadsheet template provided. **[45 minutes non-class time]**

- **Step 5:** Class 3, the competition will begin with each team having the opportunity to drive a remote control car over their bridge. The teacher will assign a pass/fail score which will be quickly added to the spreadsheet of other scores. A winning team will be announced. **[30 minutes]**

Extension:

The bridge is used due to the intense CO2 footprint of infrastructure, but this could easily be any other piece of infrastructure (building, automobile, etc). As an extension, upon completion of the fun design project, the initiative could be extended to then have students do a research project to find innovations (from self-healing cement-free concretes to carbon sink materials, etc.) within the research community and the business community to lower the footprint of our built form and to identify as part of the project what some policies might be that would encourage greener infrastructure in the future.