When designing a product, engineers and designers receive and develop a set of criteria and constraints to guide their design process. Criteria are guidelines that define the success of the design (function and style). Constraints are the real-world limits on the design (size limits, budget and schedule, environmental/human impact). At The Tech, we notice that youth are more engaged when criteria and constraints are connected to the real world. By helping youth to identify specific criteria and constraints as part of problem definition, youth have a set of benchmarks to guide design decisions and allow youth to not only celebrate what they are doing well, but also see opportunities for iteration.

**FACILITATION**

1. In Grades K-5, educators can give youth or guide youth to identify a list of criteria and constraints. For groups with less experience with design challenges, start by giving them the criteria and constraints and work toward having them identify criteria and constraints in subsequent sessions.
   a. It is helpful for youth to relate the constraints to the real-world limits of the problem.
   b. **Materials**
      i. Availability of materials can be a natural budget constraint.
      ii. Create materials constraints to support the build time (having fewer materials is often helpful if you have less build time)
   c. Offer a real-world reason for schedule to help youth understand schedule drivers (e.g. Your friend must take her medication within 30 minutes.)

2. In Grades 6 and above, youth should increasingly develop the criteria and constraints for the design. Ask youth to think about the design problem with their teams.
   a. **Criteria**: How will we know if a design is successful?
   b. **Constraint**: What are some real-world limits to designing solutions for this problem?

3. Other notes for handling criteria and constraints in a design challenge.
   a. Sometimes there might be disagreement over whether an aspect of a design is “allowed”. Deciding as a group about what makes sense for the problem allows youth to think critically about the problem and their designs.
   b. **Criteria** can be directly related to the problem, but can also be purely aesthetic (your building must match the architecture of the area) or even whimsical (e.g. Your design must include one emoji.)
   c. **Constraints** help keep designs practical and relate directly to the given situation (e.g. The CO₂ filter must be made with non-essential materials from the spacecraft.)

**FACILITATIVE QUESTIONS**

**Developing Criteria / Constraints**

- What criteria would you suggest for this project? How will we know if the designs are successful?
- Given this design challenge, what do you want to do (criteria) and what rules might limit the design (constraints)?
- What would be real world constraints that will limit our design possibilities?

**Re-focusing participants on Criteria /Constraints**

- How well does your design meet each criteria and constraint of this design challenge?
- How will your next iteration address specific criteria or constraints?
- How might engineers use criteria and constraints during the design process?
SAMPLE CRITERIA AND CONSTRAINTS FOR DESIGNING A CAR

Criteria:

• The car must comfortably seat 6 people (including the driver) to transport a family of 4 and friends.
• The car must look similar to a Ford Pinto (for nostalgia purposes).

Constraints:

• The budget for the project is $2 million dollars.
• The final prototype needs to be finished by Sunday, May 26 (to be ready for the car show).
• The car must be street legal in the United States.