

PROJECT ENGINEER

AVERAGE SALARY: \$76,000

A *project engineer's* responsibilities include schedule preparation, planning and resource forecasting for engineering and other technical activities related to the project. They may also be in charge of performance management of vendors.



Key Responsibilities: Organize team, fill out all paperwork or make sure other team members have done so. Verify all project requirements are completed.

- Lead the team in the 2 minute presentation to the judges. You may either make the entire presentation, or share it with other team members, making sure the entire presentation stays within two minutes.
- Lead the team in coming up with an interesting name for the channel. Make sure that the team name and team number are recorded on the landscape and scoring sheet. Record team number on all paperwork pages where indicated.
- Verify that all team members have a role and that all roles have been assigned to a team member. If there are less than 6 members on a team, the project engineer takes on the additional role.
- Ensure that team members have completed all required questions and documentation within these pages.
- Be responsible for handing the scoring sheet (with team member name and school information filled out) to the judges.
- Keep track of time.

TIPS FOR A GREAT PRESENTATION:

- Fully define the challenge.
- Explain your solution.
- Look at the scoring sheet to see what the judges are evaluating you on. Be sure to address those issues. Stay aware of time, but also do not rush. Making a quick list of things you want to be sure to say and practicing with a teammate ahead of time is time well spent. Space here can be used for notes.

Team Number: _____

Team Member Name: _____

CIVIL ENGINEER

AVERAGE SALARY: \$73,000

Civil engineers imagine, design, build, supervise, operate, construct, and maintain infrastructure projects and systems in the public and private sector, including roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment.



Key responsibilities: Design channel, record design ideas.

- Check supplies and verify that all the items listed have been provided.
- During design, make drawings of the proposed different parts of the channel.
- During the building phase, work with all the team members to put the different parts of the channel together.
- Create final drawings of the finished channel here. Consider what changes were made and why.

Engineers' early ideas rarely work out perfectly. Why is it important to put your design on paper first?
How does testing help to improve a design?

PRELIMINARY DRAWINGS
NOT FOR CONSTRUCTION

--- This space for civil engineer's design drawings. ---

Team Number: _____

Team Member Name: _____

CONSTRUCTION ENGINEER AVERAGE SALARY: \$80,000

Construction engineering deals with the designing, planning, construction, and management of infrastructures such as roads, tunnels, bridges, airports, railroads, facilities, buildings, dams, utilities and other projects.



Key responsibilities: Channel construction and optimization

- Work closely with the civil engineer to put design ideas into practice. Often ideas that look good on paper do not translate into success when the building starts. Redesign and refinement are common elements of the building process.

Channel Element	Did this element work the first time?	How did you change it to make it work better?
Fluid entry point (where BBs are entered into the channel)		
Support structures		
Bends in the channel		
Fluid collection area		
Other interesting or challenging elements in your channel		

Team Number: _____

Team Member Name: _____

ENVIRONMENTAL ENGINEER AVERAGE SALARY: \$78,000

Environmental engineering deals with the protection of human populations from the effects of adverse environmental factors. It also includes the protection of environments, both local and global, from potentially dangerous effects of natural and human activities.



Key responsibilities: Ensure there are no leaks in the channel or fluid spills. Collect the fluid during judging.

- The environmental engineer has a specialized focus in considering how the BBs will flow. She/he is responsible for testing and controlling the precious 10 BBs worth of fluid given to the team for testing. Points will be given for each of the BBs returned during judging.
- Work with the civil and construction engineers to design and construct elements that will maximize fluid retention. Consider places in the channel where fluid might escape and help to design solutions to prevent this.
- You must use the small baggie to collect your fluid in the round collection area. Fluid must enter the baggie within the collection area but your baggie may stick outside of this area.

Requirements	Meets Requirement (Y/N)
Fluids can be reliably entered into the channel	
Fluid goes through channel without stopping	
Fluid can make turns without spilling	
Fluid can be gathered at collection point without spilling	
Channel is stable enough to support fluid	

What variables had the greatest impact in your design (for example, weight of fluid, path through landscape)? How did you address these variables in your design approach?

Team Number: _____

Team Member Name: _____

ECONOMIST

AVERAGE SALARY: \$76,000

Economists typically research and analyze economic issues, conduct surveys and collect and analyze data using mathematical models and statistical techniques.

Key Responsibility: Lead team in developing strategy to maximize points. Be able to explain your strategy.



- Work closely with all team members to determine the best balance of design and construction.
- Count and return all unused materials for points.
- Carefully review the scoring sheet and consider cost trade-offs to the route you choose.

A **back-of-the-envelope calculation** is a rough calculation, typically jotted down on any available scrap of paper such as an envelope. It is more than a guess but less than an accurate calculation or mathematical proof. Back of the envelope calculations are used in every part of a project, from beginning to end, and can help guide the project in meaningful ways. Use the space below to make some back of the envelope calculations and comparisons to help guide your build.

Possible paths:

Materials used:

Team Number: _____

Team Member Name: _____

OPERATIONS ENGINEER

AVERAGE SALARY: \$73,000



Operations engineers make sure a company's operations, such as manufacturing and shipping, work properly and meet factory and management specifications. These engineers handle any repairs or upgrades to the machinery and coordinate with other department heads to fine-tune their operations systems.

Key responsibilities: Construct mountain and accurately place on landscape. Consider design trade-offs. Discuss these with team members who are designing, building, and pricing the channel. Insert fluid into the channel during the 30 second testing run. **When loading BBs into channel you MAY NOT touch your channel.**

A critical aspect of engineering design is in making design trade-offs. A design trade-off is a situation that involves losing one quality or aspect of something in order to gain another quality or aspect of something.

For example, the stronger you make something, the more materials you likely need to build it. More materials mean more money. As an engineer, you need to find the best balance for this trade of strength and budget. This can mean redesigning a part to use fewer materials or choosing a different route to add distance without adding as much cost.

Trade Study Topic	Trade Study Details
Loading accuracy	
Route stability	
Fluid collection considerations	

What was the most challenging requirement in this project? What was your team's approach to meeting this challenge?

Team Number: _____

Team Member Name: _____