ARCHITECTURE

2496J ~ BHS Robopatties J
Irvine, California, United States
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What is Architecture?

Architecture is not only the **product**, but primarily the **process** of planning, sketching, designing, and constructing structures that comprise our society.

Playing such an **integral role** in our homes, communities, and world, architecture is the art and science that provides us with the resources needed to **fulfill our utilitarian needs**. Architects are constantly striving to ensure that the safety and comfort offered with their designs is effectively executed.

Why Architecture?

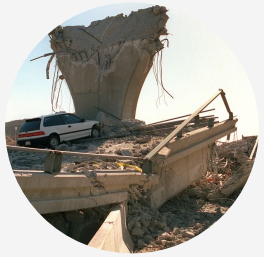
While it is an overlooked career, architecture truly **stands out to us because of how crucial it is at the local level**, specifically its every-day impact. We have the rare opportunity to recognize the parallels between the VEX program and this career up-close.

Structures throughout history have faced a multitude of challenges, but we are now better equipped to confront them due to the contribution of architecture. Our robotics team is **located in California, where earthquakes are our primary concern** when it comes to designing establishments for our community. A lack of consideration **could threaten lives in emergency situations**.

Failed support columns from 1994 Northridge Earthquake

Collapse of concrete parking structures during 1994 Northridge Earthquake

Local Exposure and Resources



Past

Element D Seismic published by the City of Irvine **identifies earthquake-related issues** that we face. After observing the failed support columns and other consequences of the 1994 Northridge Earthquake, it was evident that the **criteria and constraints were not met**. However, architects are now required to **actively consider potential earthquake hazards**.

Present

The local **Tustin Hangar Fire** greatly **impacted our lives**. The asbestos used to construct the hangar released toxic fibers into the surrounding air, closing our schools and harming our environment. Despite only seeing this **architectural error** recently, it ultimately helped **solidify the significance of the design process**.

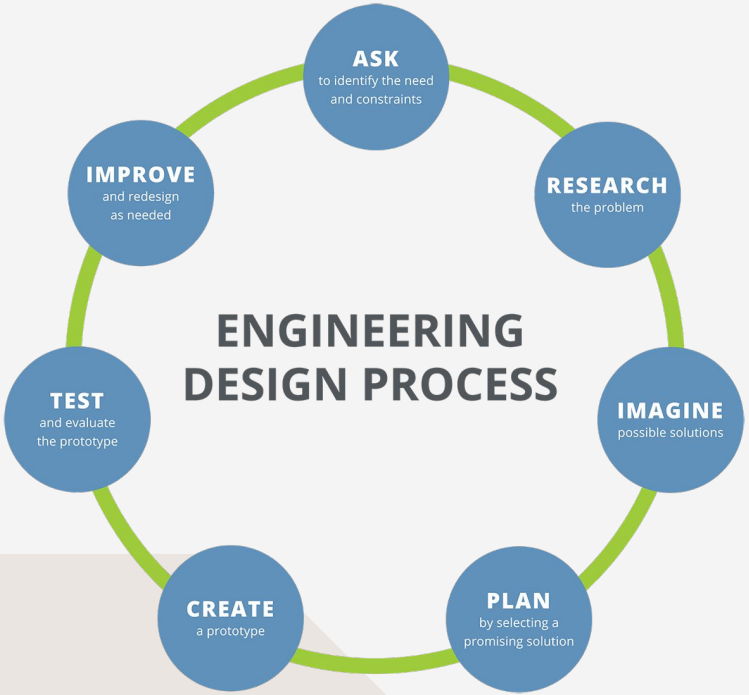
Future

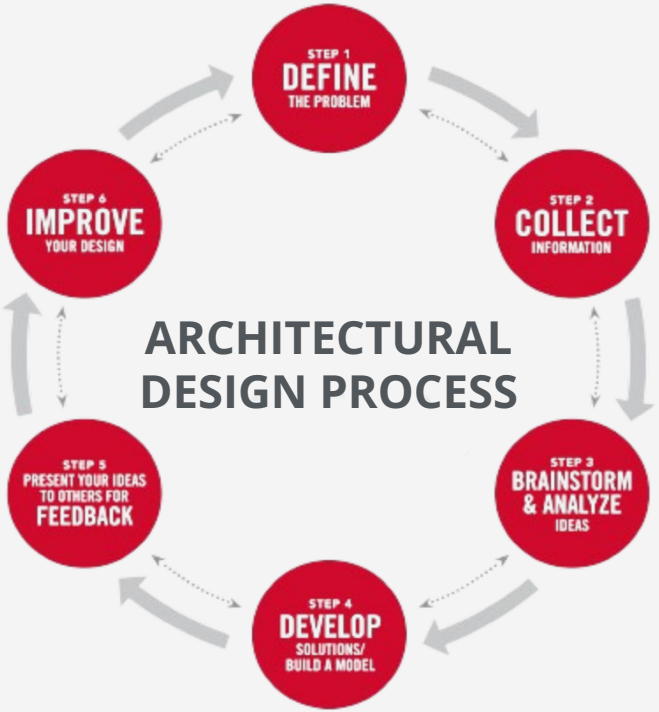
California is currently leading the movement towards **green architecture** in the future. In response to climate change, architects strive to **reduce the negative environmental impact** of their designs. Seismic-resilient features are incorporated with sustainable building designs. Structural integrity and ecological footprint are considered.

Our Professional Resource

Mr. Colin Lanning, our **Beckman Robotics coach**, majored in Architecture. His passion for learning about CAD design allowed him to serve as a **professional resource** by teaching our robotics team about CAD. From this, we are able to **generate realistic concepts**, giving us an advantage when it comes to creating the best solution. **Architecture overlaps with robotics** through not just **technology and CAD**, but the **execution of the design process** as well.

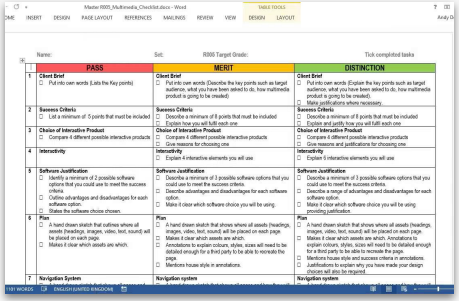
The Design Process





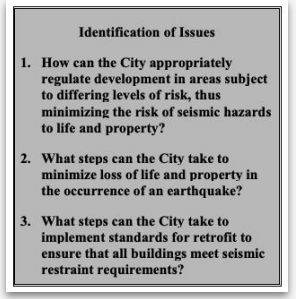
01
Define the Problem

The first step in both processes is to identify the problem by **recognizing its criteria and constraints**. Understanding the game manual helps our team clearly define the challenge. Conversely, architects receive a **design brief** containing specific requirements. This step is critical in recognizing one's goals and starting the process of implementing a solution.



	PASS	MERIT	DISTINCTION
1	**Client Brief** ☐ Put into own words (Lists the Key points)	**Client Brief** ☐ Put into own words (Describe the key points such as target audience, what you have been asked to do, how multimedia product is going to be created)	**Client Brief** ☐ Put into own words (Explain the key points such as target audience, what you have been asked to do, how multimedia product is going to be created). ☐ Make justifications where necessary.
2	**Success Criteria** ☐ List a minimum of 5 points that must be included	**Success Criteria** ☐ Describe a minimum of 8 points that must be included ☐ Explain how you will fulfil each one	**Success Criteria** ☐ Describe a minimum of 8 points that must be included ☐ Explain and justify how you will fulfil each one
3	**Choice of Interactive Product** ☐ Compare 4 different possible interactive products	**Choice of Interactive Product** ☐ Compare 4 different possible interactive products ☐ Give reasons for choosing one	**Choice of Interactive Product** ☐ Compare 4 different possible interactive products ☐ Give reasons and justifications for choosing one.
4	**Interactivity** ☐	**Interactivity** ☐ Explain 4 interactive elements you will use	**Interactivity** ☐ Explain 5 interactive elements you will use
5	**Software Justification** ☐ Identify a minimum of 2 possible software options that you could use to meet the success criteria ☐ Outline advantages and disadvantages for each software option ☐ States the software choice chosen.	**Software Justification** ☐ Describe a minimum of 3 possible software options that you could use to meet the success criteria. ☐ Describe advantages and disadvantages for each software option. ☐ Make it clear which software choice you will be using.	**Software Justification** ☐ Describe a minimum of 3 possible software options that you could use to meet the success criteria. ☐ Describe a range of advantages and disadvantages for each software option ☐ Make it clear which software choice you will be using; providing justification.
6	**Plan** ☐ A hand drawn sketch that outlines where all assets (headings, images, video, text, sound) will be placed on each page. ☐ Makes it clear which assets are which.	**Plan** ☐ A hand drawn sketch that shows where all assets (headings, images, video, text, sound) will be placed on each page. ☐ Makes it clear which assets are which. ☐ Annotations to explain colours, styles, sizes will need to be detailed enough for a third party to be able to recreate the page. ☐ Mentions house style in annotations.	**Plan** ☐ A hand drawn sketch that shows where all assets (headings, images, video, text, sound) will be placed on each page. ☐ Makes it clear which assets are which. Annotations to explain colours, styles, sizes will need to be detailed enough for a third party to be able to recreate the page. ☐ Mentions house style and success criteria in annotations. ☐ Justifications to explain why you have made your design choices will also be required.
7	**Navigation System**	**Navigation system**	**Navigation system**

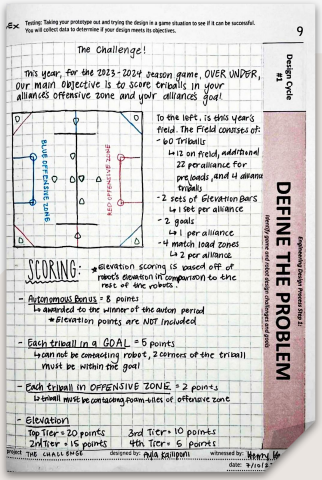
Architecture client design brief



Identification of Issues

1. **How can the City appropriately regulate development in areas subject to differing levels of risk, thus minimizing the risk of seismic hazards to life and property?**
2. **What steps can the City take to minimize loss of life and property in the occurrence of an earthquake?**
3. **What steps can the City take to implement standards for retrofit to ensure that all buildings meet seismic restraint requirements?**

City of Irvine: *Element D*, Seismic



Defining the problem of the 2023-2024 season

VRC Over Under Game Manual

Specific Game Rules

<SG1> Starting a Match. Prior to the start of each *Match*, the *Robot* must be placed such that it is:

a. Contacting at least one (1) of their *Alliance's Starting Tiles*. See Figure 26.

b. Not contacting any *Starting Tiles* in the same *Offensive Zone* as their *Alliance* partner. One *Robot* must be in the red *Offensive Zone*, and one must be in the blue *Offensive Zone*. See Figure 20.

c. Not contacting any other gray foam field tiles, including the *Match Load Zones*.

d. Not contacting any *Triballs* other than a maximum of one (1) *Preload*. See rule <SG4>.

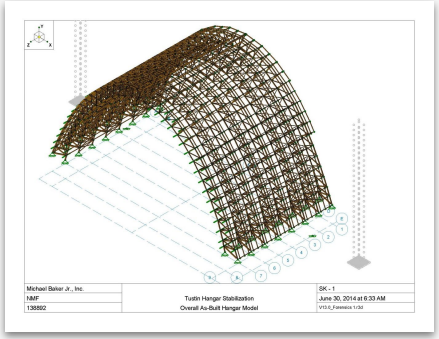
e. Not contacting any other *Robots*.

f. Not contacting any *Barriers* or *Elevation Bars*.

Official 2023-2024 Game Manual

02
Brainstorm and Analyze Ideas

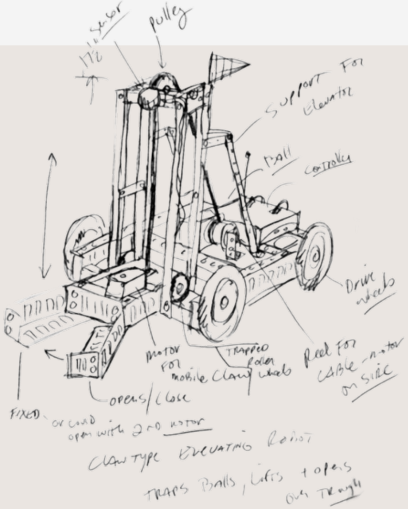
After a clear objective has been determined, we research potential solutions and generate concepts. **CADs, drawings, and labeled sketches** help us document our thought process. Similarly, **architects conceptualize a multitude of designs**, brainstorm, and critically analyze these drafts for feasibility, cost, comfort, safety, and a plethora of other requirements. These brainstorms are executed through **blueprints and documentation**.



Tustin Hangar framework CAD

2496J's second robot iteration CAD

Researching robot design ideas

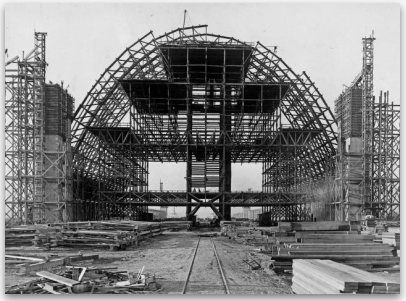


Sketching robot designs

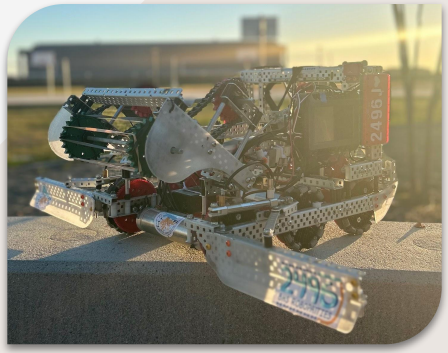
03
Develop Solutions/Build a Model

Architects recognize which criteria and constraints should be prioritized. They build **prototypes** of their designs to determine if certain ideas are realistic. In VEX, we are constantly building prototypes of our subsystems to gain a better understanding of its advantages and disadvantages. **These models are tested** to determine if the idea can be developed into a working solution.

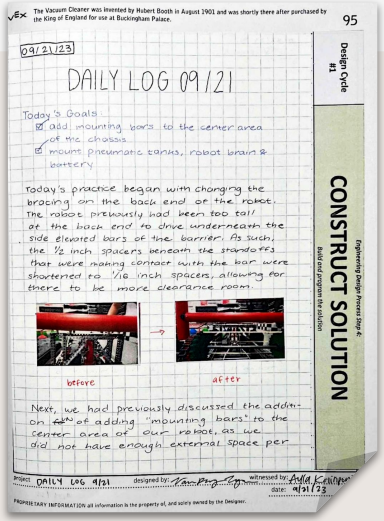
Simulated earthquakes using shake tables



Tustin Hangar construction



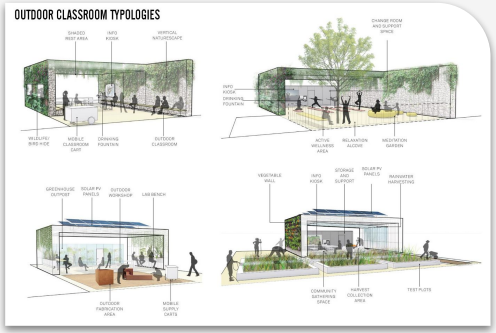
Completed V1 robot design



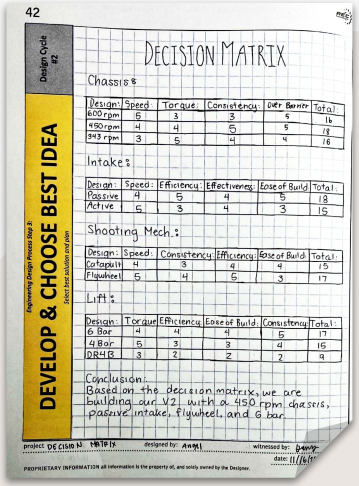
Construction of best solutions

04
Present Ideas for Feedback

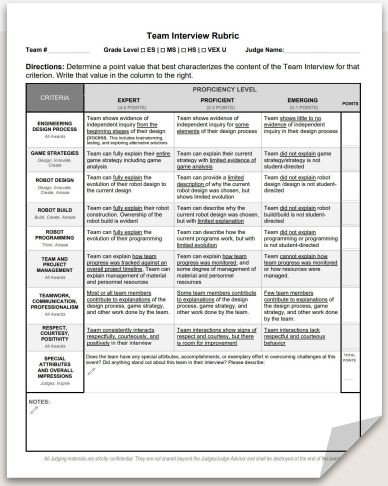
We utilize **decision matrices** to finalize solutions numerically from an unbiased perspective. With architecture, designs are **presented to clients for feedback**, and the best designs are chosen based on their needs. Although the methods used to select final designs may differ, they are both chosen with impartiality.



UCI classroom design presentation



Decision Matrix to select best solution

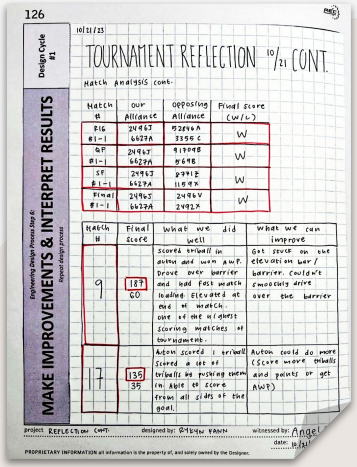


VEX VRC interview rubric

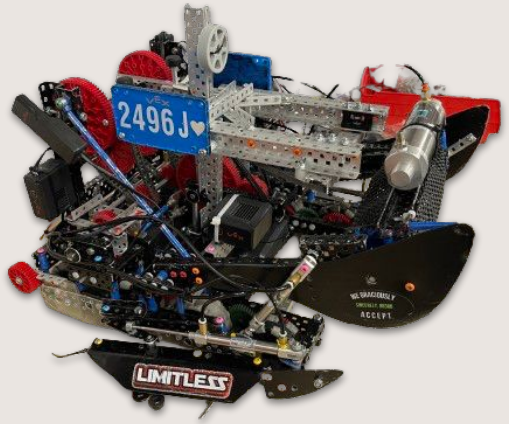
05
Improve Your Design

We understand that the design process is a **cyclic procedure**, so this step allows architects and engineers to either **continue forward with building**, or return to **re-evaluate their designs**. After architects receive feedback from their clients, they will adjust their designs as necessary. For our robotics team, **robot performance** and **tournament results** allow us to **make the essential improvements** upon our designs.

Anchored earthquake-proof building



Reflecting on tournament performance

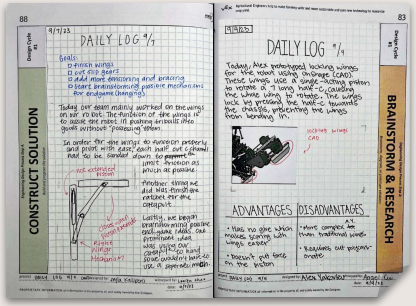


Current iteration of our robot

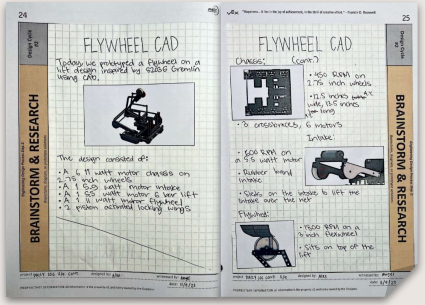
How Are We Prepared for the Future?

Our experience with VEX Robotics improved our prioritization of the engineering design process. Within both processes, similarities and variations were identified in their respective fields. Our design process **documentation** creates opportunities for us to utilize and understand the innovative cycle found in our future careers.

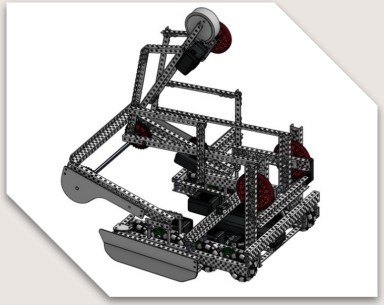
VEX also provides the perfect environment to learn skills used in STEM careers. CAD is a useful tool that architects, engineers, and other careers utilize to visualize their ideas. We learned how to **CAD and use it to present our solutions**. Through practice, our skill sets will only continue to grow.



Documentation of design process



Documentation of CAD



CAD of our robot design

How Are We Prepared for the Future?

In architecture and careers outside of STEM, working alongside peers, collaborating towards common goals, and effectively communicating are invaluable skills that prepare us for our futures. **Knowledge, experience, and connections are crucial abilities learned from VEX that will enable us throughout our careers and beyond.**

2496J at LMA Tournament

Excellence at LMA Tournament

2496J Team Meeting

THANKS!

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Researched Works

- https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-process-steps
- https://arthistoryteachingresources.org/lessons/architecture-since-1900/
- https://www.britannica.com/topic/architecture
- https://legacy.cityofirvine.org/civica/filebank/blobdload.asp?BlobID=20691
- https://www.linkedin.com/pulse/green-building-practices-california-pioneering-sofía-contreras#:~:text=Energy%2DEfficient%20Structures,into%20the%20state's%20abundant%20sunshine.