

The

STEAM cycle

Phase 1:

Investigation

Research to learn general,
overall, information.

Goal: Learn enough to find
an interesting topic.

Unit 1:

Living in a Sustainable Future

Overall Science Goals

- Impact on terrestrial and aquatic ecosystems
- Impact of elements and chemicals
- Understand organization of the periodic table
- Electricity production (renewable and non-renewable)
- Use scientific investigation skills
- Career pathways related to food, crop, and sustainable sciences.

Possible Project Ideas



The World's First 3-D Printed School May Soon Be a Reality

Thinking Huts, a nonprofit founded by a 15-year-old, plans to kick off construction in Madagascar

3D model



A Canadian Company Upcycles Millions of Disposable Chopsticks into Sleek Furniture and Home Goods

Built Product

1. Investigation

Research to learn general, overall, information.
We are attempting to learn enough to find an interesting topic.

Some Guiding Questions:

- How do humans interrupt natural environmental processes?
- What is sustainability? What are the benefits of sustainability?
- What measures can communities and/or individuals take to help protect the environment?
- In what ways do our individual choices contribute to global issues?
- What is a carbon footprint? How can we calculate a carbon footprint?
- What can we do to improve our communities for the next generation?

1. Investigation

Content
Knowledge
in Science.

Content
Knowledge
in Math.

Non-fiction
reading about
social ethical
issues (civics)

Fiction
reading about
social ethical
issues.

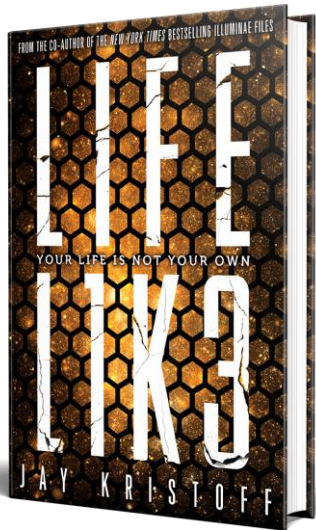
Art critique of
engineering
AND related
art.

English

READING AND LITERATURE STUDIES

- 1. Reading for Meaning:** read and demonstrate an understanding of a variety of literary, informational, and graphic texts, using a range of strategies to construct meaning;
- 2. Understanding Form and Style:** recognize a variety of text forms, text features, and stylistic elements and demonstrate understanding of how they help communicate meaning;
- 3. Reading With Fluency:** use knowledge of words and cueing systems to read fluently;
- 4. Reflecting on Skills and Strategies:** reflect on and identify their strengths as readers, areas for improvement, and the strategies they found most helpful before, during, and after reading.

Our goal: to
spark an
interesting
topic in the
students.



Dystopian –
World of
Garbage?



Choose
fiction that
relates to
topic.

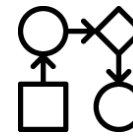
Answer formats:
6 Line
Questions,
Define, MC



Point



Detailed
Evidence



Analysis

Short Writing Task

- 1 Identify an important environmental issue. Use specific details to explain why it is important.

E-waste is an important environmental issue because it is extremely toxic.

When people throw electronics in the regular waste, they introduce poisonous substances into landfills. Circuit boards contain lead, tin, and other metals that dissolve into rainwater causing cancer, brain damage and harm to internal organs. The severe health problems caused by the toxins in e-waste makes its improper disposal an important issue.

Phase 2:

Problem

Definition

Brainstorming. Lateral thinking. Sketching.

Goal: choose a specific problem they wish to solve.

Specifications List

The problem used below: Use cardboard to build a tower capable of supporting a 100-pound gravity load and a 10-pound lateral load simultaneously. This exercise closely replicates problems faced by real-world skyscraper designers.



Specifications List

1. Tower will only be built out of cardboard and glue.
2. Tower will stand at least 1 m (3 ft) tall.
3. Tower will use minimal amounts of building materials.
4. Tower will support 100 pound gravity load and a 10 pound load simultaneously.
5. Tower will replicate problems faced by and solutions created by real-world skyscraper designers.

2. Problem Definition

Brainstorm
ideas.

Skills
development:
writing, art,
safety, tech.

Choose a
problem.

Tech

Science

We need to employ a series of brainstorming techniques to generate an ideas list.

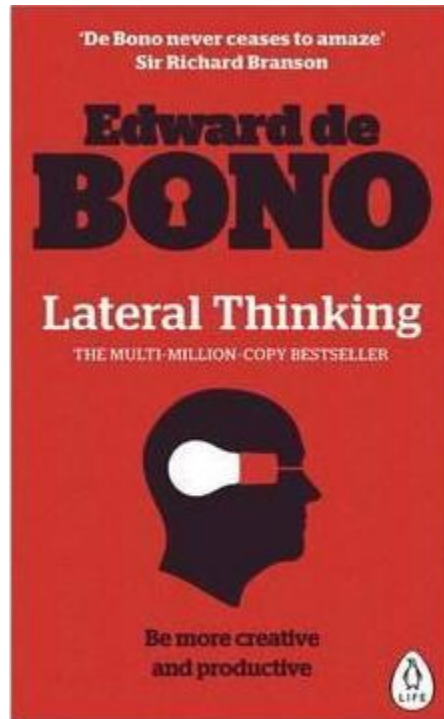
Brainstorming is an active process.

Random entry idea generation

The thinker chooses an object at random, or a noun from a dictionary and associates it with the area they are thinking about. De Bono exemplifies this through the randomly-chosen word, "nose", being applied to an office photocopier, leading to the idea that the copier could produce a lavender smell when it was low on paper.

Provocation idea generation

A provocation is a statement that we know is wrong or impossible but used to create new ideas. De Bono gives an example of considering river pollution and setting up the provocation, "the factory is downstream of itself", causing a factory to be forced to take its water input from a point downstream of its output, an idea which later became law in some countries. Provocations can be set up by the use of any of the provocation techniques—wishful thinking, exaggeration, reversal, escape, distortion, or arising. The thinker creates a list of provocations and then uses the most outlandish ones to move their thinking forward to new ideas.



2. Problem Definition

Brainstorm ideas.

Skills development: writing, art, safety, tech.

Choose a problem.

Take your three problems, pick one.

Fashion

Recycled Plastic Bottles Reinvent Sustainable Fashion

Solution by ReuseTape

→ Using recycled plastic bottles, this solution creates adaptable and high-performance fabrics that are being integrated seamlessly with fashionable designs.

Efforts to create sustainable fashions are often faced by their common association with the niche or alternative markets, through its partnerships with global brands like Patagonia, H&M, and H&M, has been making significant strides in altering this perception.

With a 40% to 60% recycled plastic content, ReuseTape offers up to 100% more strength using with greater abrasion resistance than conventional materials, making its applications considerably as a more recent development, **plastic debris associated with the ocean** by marine organizations and recycling companies, we're specifically situated in the context of some, very, as part of the very low impact initiatives.

Why a Sustainable Solution?

According to the United Nations' annual World Water Development Report, around 2.5 billion people live in areas with limited access to clean water. The report also highlights the problem of plastic pollution, which is becoming a major concern for many countries, and is expected to increase, along with the need to reduce waste, to improve sustainability.

How ReuseTape works?

ReuseTape is a sustainable fashion brand that uses recycled plastic bottles to create high-performance fabrics. The brand's mission is to create sustainable fashion that is both functional and fashionable. ReuseTape's fabrics are made from recycled plastic bottles, which are shredded and melted into a new fabric. This process is sustainable and reduces waste.

ReuseTape's Impact

ReuseTape has a positive impact on the environment by reducing waste and promoting sustainability. The brand's fabrics are made from recycled plastic bottles, which are shredded and melted into a new fabric. This process is sustainable and reduces waste. ReuseTape also promotes sustainable fashion by using eco-friendly materials and processes.

Resources

Biodegradable Diapers Reducing Waste

Solution by gNappies and gDiapers

→ With gNappies' compostable diapers, families can reduce waste significantly during the first years of a baby's life.

Diapers account for as much as 10% of household waste in homes with young children. gNappies and gDiapers are designed with a **reusable cover** and a **biodegradable disposable insert**, which the insert is sealed, it is removed and can be composted with food waste or flushed down the toilet.

The cover is made from reusable cotton and fluted wood pulp which comes from **sustainable** sources and **biodegradable** material that is long granulated so the cover can be washed together with reusable clothes. The diaper inserts contain sodium polyacrylate, a plant-based, non-toxic water absorbing polymer.

Why a Sustainable Solution?

According to the United States Environmental Protection Agency, diapers account for 7% of all waste in the U.S. In 2012, the United States alone, 1.5 billion diapers were used. 75 billion of plastic for plastic, and 50 billion of plastic for plastic. gNappies and gDiapers are made from biodegradable materials and are designed to be composted or flushed down the toilet.

How gNappies and gDiapers work?

gNappies and gDiapers are designed to be reusable and biodegradable. The reusable cover is made from cotton and fluted wood pulp, which is long granulated so the cover can be washed together with reusable clothes. The disposable insert is made from sodium polyacrylate, a plant-based, non-toxic water absorbing polymer. The insert is sealed and can be composted with food waste or flushed down the toilet.

gNappies and gDiapers' Impact

gNappies and gDiapers have a positive impact on the environment by reducing waste and promoting sustainability. The brand's diapers are made from biodegradable materials and are designed to be composted or flushed down the toilet. gNappies and gDiapers also promotes sustainable fashion by using eco-friendly materials and processes.

Vertical Ocean Farming Creates Healthy Ecosystems

Solution by GreenWave

GreenWave's vertical ocean farming systems assist ocean farmers in producing healthy and local foods, while capturing carbon and providing a source for biofuel.

ENVIRONMENTAL

GreenWave's vertical ocean farming systems assist ocean farmers in producing healthy and local foods, while capturing carbon and providing a source for biofuel. The system uses a vertical stack of floating rafts, which are anchored to the seabed. The rafts are made from recycled plastic bottles, which are shredded and melted into a new fabric. This process is sustainable and reduces waste.

SOCIAL

GreenWave's vertical ocean farming systems assist ocean farmers in producing healthy and local foods, while capturing carbon and providing a source for biofuel. The system uses a vertical stack of floating rafts, which are anchored to the seabed. The rafts are made from recycled plastic bottles, which are shredded and melted into a new fabric. This process is sustainable and reduces waste.

ECONOMIC

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How GreenWave works?

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GreenWave's Impact

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6 liner to justify choice. 2 more to justify not picking others.

2. Problem Definition

Brainstorm
ideas.

Skills
development:
writing, art,
safety, tech.

Choose a
problem.

English

Civics

Tech

Science

Art

Students will take
their three best
ideas and make
three elevator
pitches.

Based on
Define/
Significance.

Filmed.

30 seconds.

Oral mark.

Phase 3:

Analysis

Brainstorm solutions, experiment with prototypes, sketch ideas to solve problem.

Further research into specific topics.

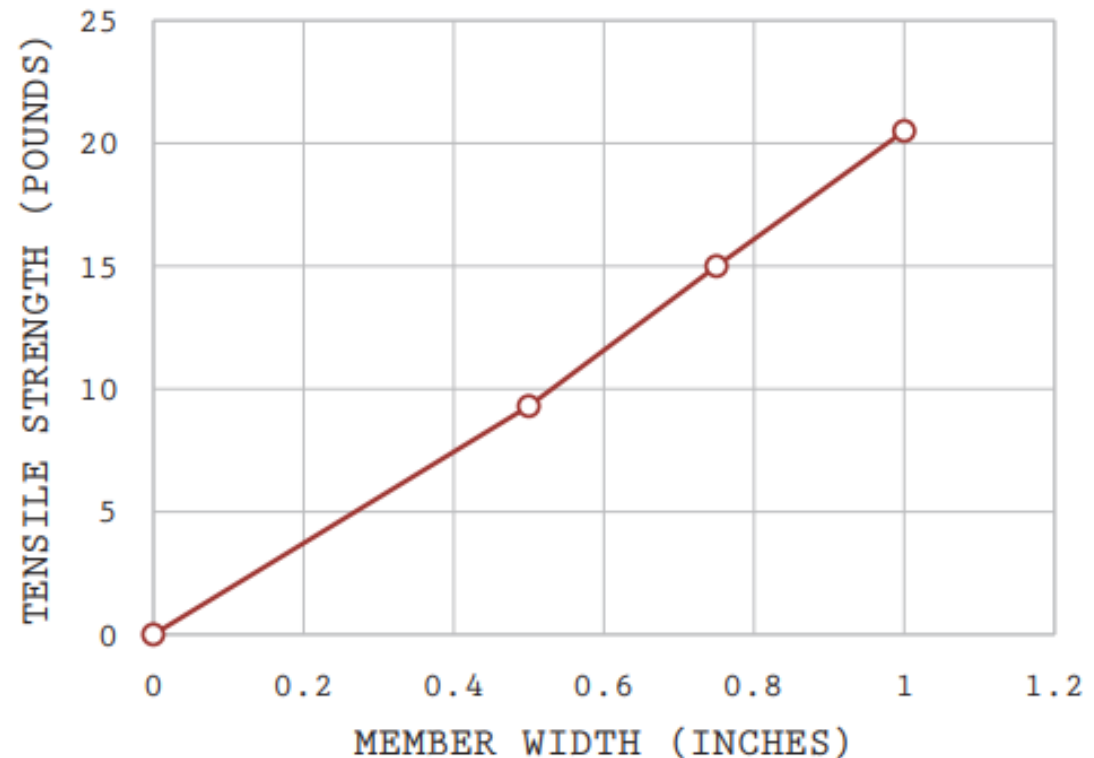
Create a specifications list.

Goal: Develop possible solutions.

The RRS might contain experiments to learn about design constraints.

Experimental Determination of Tensile Strength

The tensile strength of file-folder cardboard has been determined experimentally by using a lever-based testing machine to load cardboard specimens of various widths until they rupture. Drawings and a materials list for the testing machine are provided in appendix A. Use of this machine is demonstrated in lesson 3. Results of the tests are shown in the graph of tensile strength versus member width below.



3. Analysis

Further research into their specific topic.
Create a list of specifications (success criteria) for their project.

Research
more into
topic.

Create
specifications
List.

Content
Knowledge
in Science.

Content
Knowledge
in Math.

Skills
development:
writing, art,
safety, tech.

Some Guiding Questions

- How do we improve environmental aspects in design when cost becomes a factor?
- Do governments and individuals have equal responsibility to protect the environment?
- How can designers balance the needs of the environment with the needs of stakeholders?
- What are environmentally conscious building techniques?
- How can we create a 3D model?

Phase 4:

Design

Evaluate solutions, choose one.

Draw or build prototypes.

Generate Materials list. Layout artistic design.

Goal: Create model of solution.

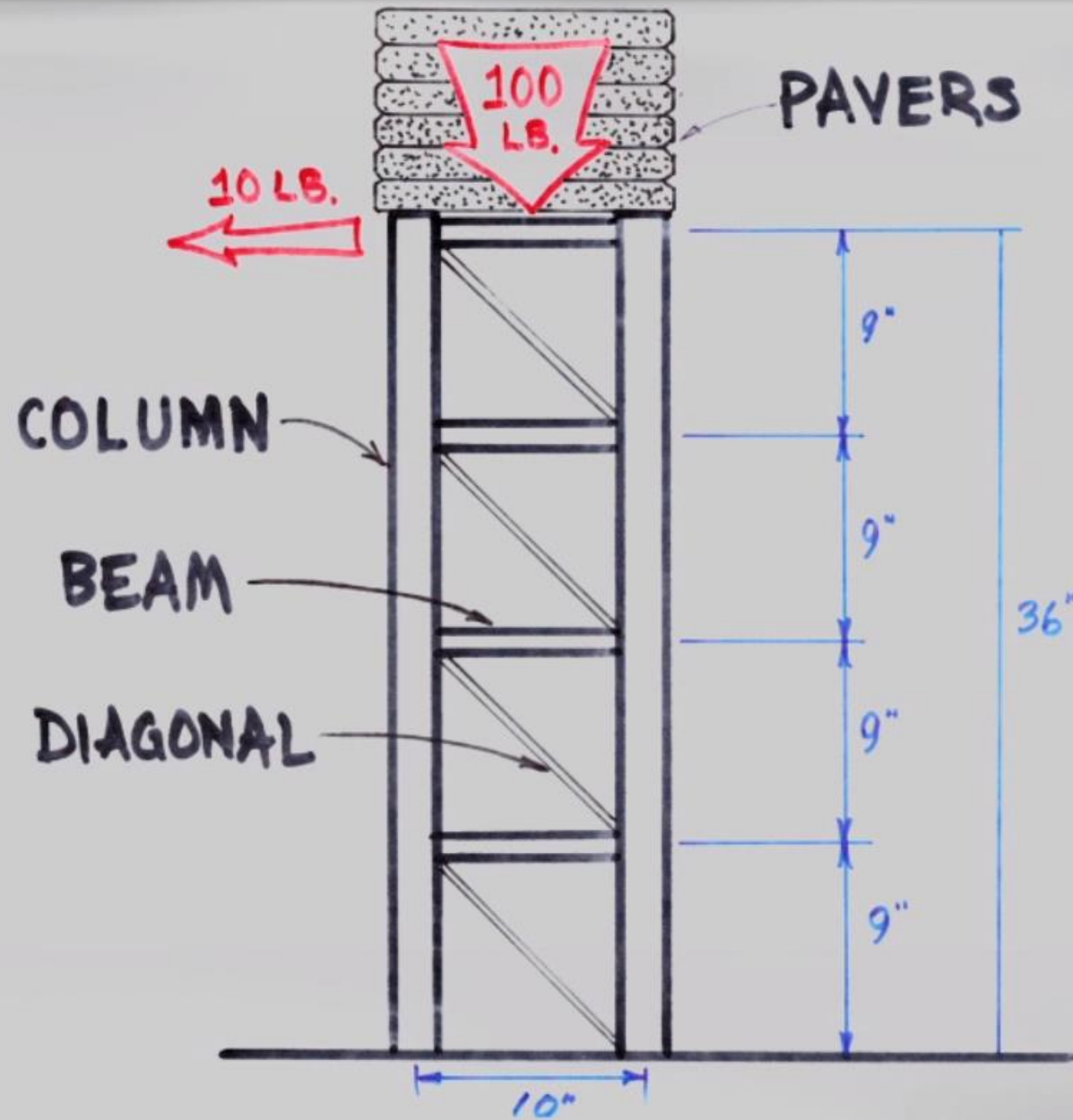
MATERIALS LIST

NAME	DESCRIPTION
Column (8)	1" × 1" × 18" corrugated cardboard tube formed around a $\frac{3}{4}$ " × $\frac{3}{4}$ " core
Beam (16)	1" × $\frac{1}{2}$ " × 8 $\frac{3}{4}$ " corrugated cardboard tube formed around a $\frac{3}{4}$ " × $\frac{1}{4}$ " core
Diagonal (48)	$\frac{5}{16}$ " × 13 $\frac{5}{8}$ " manila file-folder cardboard
Gusset plate A (12)	See full-size template.
Gusset plate B (12)	See full-size template.
Gusset plate C (36)	See full-size template.
Connecting plates (32)	See full-size template.
Lower footing (8)	2" × 2" corrugated cardboard
Upper footing (8)	$\frac{3}{4}$ " × $\frac{3}{4}$ " corrugated cardboard
Base	14" × 14" × $\frac{3}{4}$ " plywood or MDF

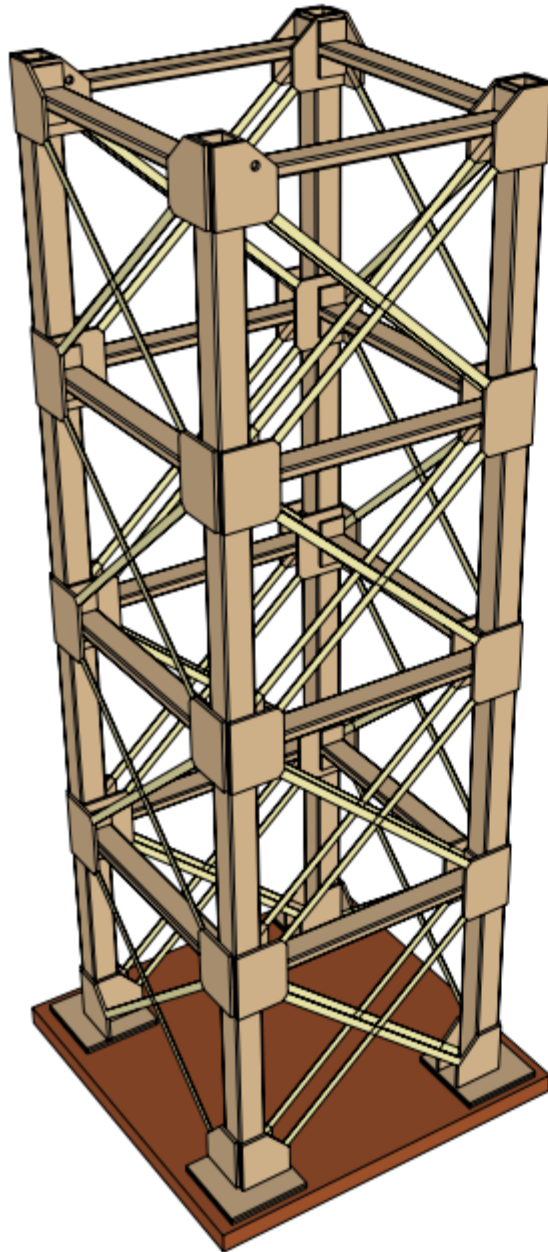
The following supplies and tools are used to construct the tower:

- ▶ one 18" cardboard moving carton
- ▶ one legal-size file folder
- ▶ wooden base
- ▶ wood glue
- ▶ wax paper
- ▶ sewing pins
- ▶ $\frac{3}{4}$ " $\times$ $\frac{3}{4}$ " metal or wooden core for forming columns
- ▶ $\frac{3}{4}$ " $\times$ $\frac{1}{4}$ " metal or wooden core for forming beams
- ▶ scrap wood for tube-forming jig
- ▶ hobby knife or single-edge razor blade
- ▶ scissors
- ▶ clamps
- ▶ weights (to be used as clamps)

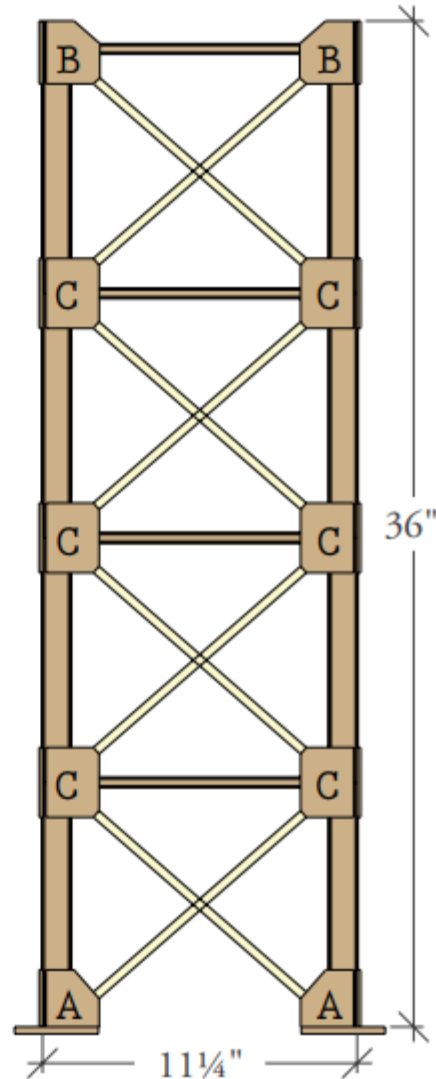
The RRS
might
contain
design
drawings



Drawing 2.1 » Tower perspective view



Drawing 2.2 » Tower elevation view, showing three gusset-plate designations



The RRS
might
contain
designs in
Sketch-up

Phase 5:

Creation

Build final product.

Apply and demonstrate skills. Edit work carefully.

Goal: Create fully complete solution to problem.

A wooden workbench in a workshop setting, covered with various cardboard components. In the upper left, there is a grid of small, square cardboard pieces. To their right, a series of long, rectangular cardboard strips are laid out in a row. Further right, another set of long, rectangular cardboard strips is visible, some of which are stacked. In the foreground, several small, square cardboard pieces are scattered. A blue speech bubble is overlaid on the left side of the image, containing text. The background shows a workshop environment with shelves holding various items and a wooden wall.

The RRS
might
contain
process
photographs



The RRS
might
contain
process
photographs



The RRS
might
contain
process
photographs

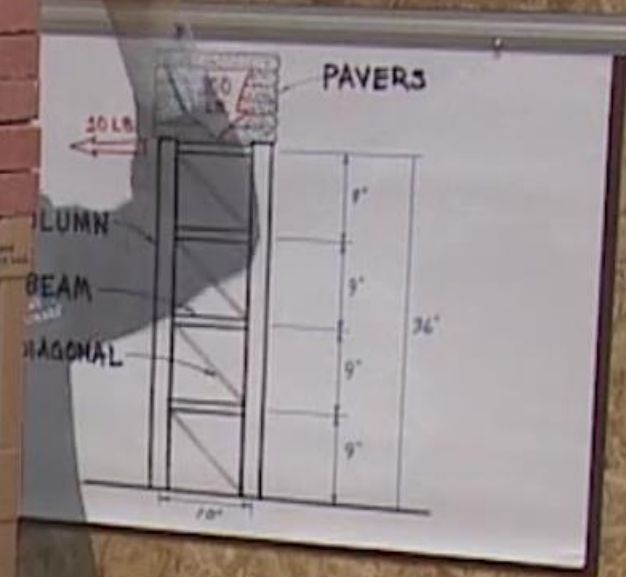


Phase 6:

Testing

Alpha testing, Beta testing.
Peer testing. Proof reading.
Test against specifications.
Goal: Fully test final
product.

The RRS
might
contain
evidence of
testing



Phase 7:

Reflection

Evaluate solution.

Present solution to others.

Goal: Understanding of
successes and creation of
future goals for improvement.

The STEAM Cycle

1. Investigation

2. Problem Definition

3. Analysis

4. Design

5. Creation

6. Testing

7. Reflection



IPADCTR

The acronym.

Pronounced: iPAD-Ki-TeR