DAY 1  HOW BUILDINGS WORK
Let’s explore two building techniques, load-bearing and skeleton-frame construction, through a quick warm-up in two parts that will get our heads thinking about the differences, advantages, and limitations between the two.
LOAD-BEARING CONSTRUCTION

The first part will use your “stackables.” Using your books, blocks, or other stackables, build a tower as tall as possible. Then consider the following questions:

- Was it easy or difficult to build this way? What was easy? What was difficult?
- How stable was your tower? How could you improve your tower’s stability?

You just built a load-bearing structure! The individual components transfer the load of your structure from the individual parts to the wall, and from the wall to the foundation you built on!
WARM-UP

LOAD-BEARING CONSTRUCTION

Your stackables might look something like this:

- How tall are you able to build?
- Does this seem like a safe and stable way to build tall?
WARM-UP

SKELETON-FRAME CONSTRUCTION

The second part uses the toothpicks and marshmallows, gum drops, modeling clay, or anything soft and squishy.

Using toothpicks as beams (horizontal supports) and columns (vertical supports), and modeling clay as joints, try building a simple shape.

- Can you make squares with the toothpicks?
  How about a triangle?

- Which shape is stronger? How can you tell?

Once you have your first shape, try building up and joining more toothpick shapes together!
SKELETON-FRAME CONSTRUCTION

In a skeleton frame structure, the “toothpicks” make up the strong bones that keep a building from falling over.

Can you think of any challenges you might face while building this way?
LOAD-BEARING VS. SKELETON-FRAME CONSTRUCTION

You’ve put together a skeleton-frame structure! In this case, the load is transferred from the individual pieces to the beams, from the beams to the columns, and finally from the column to the foundation.
LOAD-BEARING VS. SKELETON-FRAME CONSTRUCTION

Load-bearing construction is a traditional method of construction, and it is a great option for building smaller structures. Load-bearing structures can become unstable and wobbly as they get taller. They require wider bases in order to be safe enough to live or work in.

Steel-skeleton frame buildings can be a little more flexible. This is the standard construction technique used in skyscrapers, buildings taller than 10 stories. With a strong steel skeleton, the building’s exterior can be made of many different materials.
**Constraints** are restrictions or limitations. For example, lot sizes, budgets, and project deadlines are all constraints that affect an architect’s work.

A **force** is a push or pull that is applied to an object. Forces that buildings and other structures are subjected to include **gravity**, **compression**, and **tension**.

**Gravity** is a force that attracts one object to another. On Earth, gravity keeps our feet on the ground by attracting everyone and everything to its center.

**Compression** is a force that shortens, or compresses, an object. Its opposite, **tension**, elongates, or stretches, an object.
**VOCABULARY**

**HOW BUILDINGS WORK**

*Load-bearing* structures carry the weight, or load, of the building on the walls themselves. Load-bearing structures feel compression more than tension, and the construction technique is typically used for buildings that are shorter than ten stories.

*Steel-skeleton frame* buildings are supported by an interior steel frame that carries the building load. Steel-skeleton frame buildings rely on both compression and tension to stand.

A *residential* building is designed for people to live in.
STEP 1: DEFINE THE PROBLEM

It’s time to move on to the first step of the Design Process for this week’s main challenge:

• Design and build a residential building in your corner of the city
DESIGN PROCESS

STEP 2: COLLECT INFORMATION

Collect information about the place you live in and the things around it.

Keep a safe distance from other people while you explore outside, or simply look at your home and other residential buildings from your porch, balcony, or even out the window.
STEP 2: COLLECT INFORMATION

While observing your home and the places close to it, ask yourself the following questions and record your answers:

• What does the place I live in look like?
  How tall is it? How wide is it? How many people can live here?
  Example: “My apartment building is five stories tall, and very narrow. I think at least 16 people can live in my building.”

• What places/things can I see from my home?
  What places/things are close by? What is far away?
  Example: “I can see a bus stop and a grocery store nearby. I can see that there’s a train station a long walk away.”
**STEP 2: COLLECT INFORMATION**

While observing your home and the places close to it, ask yourself the following questions and record your answers:

- **How many buildings can I see around me?**
  Example: “If 20 people live in my building, the buildings around mine and across the street can also probably accommodate at least 20 people. I estimate that there are probably about 100 people living in the buildings immediately adjacent to mine.”

- **What kinds of places are close to my home?**
  Is there a bus or train stop? Are they mostly other homes? Is there a place to buy food?”
By making observations of your home and its surroundings, you have completed Steps 1 and 2 of the Design Process! In Day 2, you will continue working through the remaining Steps and work toward the week’s main challenge.

If you have any ideas for your final build, be sure to record them on paper!

Continue making observations about the places around you as you move through this week’s activities and practice Design Thinking.