REACH FOR THE SKY

**EDUCATOR GUIDE**

# EDGE AT HUDSON YARDS: VIRTUAL FIELD TRIP

## OBJECTIVES

Students will:

- **Research** the history of Edge and the Hudson Yards neighborhood in Manhattan.
- **Simulate** the role of material scientists to examine galvanized steel.
- **Develop** and test a hypothesis on how elevators in skyscrapers work.
- **Understand** how sustainable design accounts for the realities of climate change and its own carbon footprint.

## IMAGINE THIS...

You're standing on the highest outdoor sky deck in the Western Hemisphere, and you feel like you are suspended in mid-air. 100 stories above the iconic New York City skyline, you take in the 360° views.

This might seem like a dream, but it's real! The Edge sky deck offers visitors the experience of a lifetime. Edge is located in Hudson Yards, an innovative development that is a prototype for future smart cities. As students explore Edge through this virtual field trip, they will see three things over and over again: steel, elevators, and glass. Without these three modern marvels, Edge would not be possible. This educator companion guide contains three activities designed to get students thinking about structures and forces that we often take for granted, and the heights they can reach when they're in the hands of visionaries.

## ACTIVITY OPTIONS

### Activity 1: Deconstructing Steel

The story of the modern city is the story of steel.

#### OVERVIEW

Modern skyscrapers could not exist without steel, and neither could modern transit. Edge is a living laboratory of steel where visitors can explore the many attributes of the material. In this activity, students will engage in a virtual scavenger hunt to find ten different examples of steel being used in and around the neighborhood you can see from Edge. As they identify ten different ways steel is used, students will also explore how the material is modified for each specific purpose. Finally, students will draw inspiration from the visionary sustainable practices used at Edge to ideate ways other skyscrapers can reduce their carbon footprint.

## TIME

45 minutes

## MATERIALS

- Devices with access to the internet (one per student group)
- **Deconstructing Steel** student capture sheet (one per student)
- Writing utensils

## INSTRUCTOR NOTES

1. Divide students into groups of 4–5.
2. Distribute one computer or internet-enabled device to each group.
3. Begin by providing the following brief overview of the activity:
    a. This activity looks at the many ways steel is used in construction. To examine this, we will conduct a virtual scavenger hunt of one small portion of New York City.
    b. As we identify different areas where steel is used, we will think about how that steel is processed according to its use. Conduct a quick overview of the American Iron and Steel Institute website. Be sure to highlight:
        i. The Steel Wheel
        ii. Markets
        iii. Sustainability
4. Hand out one copy of the **Deconstructing Steel** capture sheet to each student, ensuring that each has a writing utensil.
5. Walk students through the instructions written on the **Deconstructing Steel** capture sheet (a key with locations identified is included for your use).
6. Provide students with 25–30 minutes to complete their capture sheets.
7. When students are finished, review with the following summarizing questions:
    c. Did you know that there were so many different types of steel?
    d. How do we interact with steel in our everyday lives without even thinking about it?
    e. Why does steel need to be manufactured differently for different uses?
    f. Why is steel an essential material for constructing skyscrapers like 30 Hudson Yards where Edge is located? What qualities and characteristics does steel have that make it the go-to material for high rise buildings?
    g. What role does steel play in a sustainable future and creating future green developments, like Hudson Yards and Edge?

## Activity 2: Elevation

Elevators go hundreds of feet straight up into the sky, battle wind and weather, and transport thousands of pounds. How is this possible?

### OVERVIEW

Edge at Hudson Yards uses double-decker elevators to transport its visitors to its sky deck. This innovation allows for many visitors to experience Edge at the same time. The Edge elevator is not your common elevator experience, but it does follow the same scientific and engineering principals as a regular elevator. In this activity, students will conduct an experiment to see how elevators function. By constructing their own model, students develop an understanding of the forces at work behind a modern marvel that is now a common everyday convenience—the elevator.

### TIME

60 minutes

### MATERIALS

- Access to the website "Elevator Physics"
- Access to "Elevator 101" overview guide, to be projected on a screen in front of the class
- **Elevation** student capture sheet (one per group)
- Cardboard boxes
- String
- Scissors/crafting knives (to cut holes in boxes)
- Tape
- Glue
- Popsicle sticks/dowels
- Pipe cleaners
- Wooden blocks, coins, glass beads (to use as weights of 100g/one quarter of a pound)

### INSTRUCTOR NOTES

1. Ask students to raise their hands if they have ever been in an elevator. Invite students who raised their hand to describe their experience.
2. Direct students to call out different functions or tasks an elevator must perform in order to function properly. These include:
    a. Moving up and down
    b. Stopping at specific floors
    c. Carrying a certain amount of weight

d. Doors that open and shut

e. Safety features like automatic door opening, fire alarms, etc.

3. Review the "Elevator Physics" simulation and webpage. Explain how elevators use the force of gravity to transport people and things.
4. Project "Elevator 101" so that the entire class can see it. Direct students to the "main components of an elevator" section. Identify each of the following core components of an elevator:

    f. Car

    g. Hoist Way

    h. Machine Drive System

    i. Control System

    j. Safety System

5. Divide students into groups of 4–5. Distribute one copy of the **Elevation** student capture sheet to each group.
6. Provide students with 30 minutes to build their elevator according to the criteria and constraints listed on the capture sheet.
7. When students have completed their models, invite each group to demonstrate their model.
8. When each group has presented, ask the following summarizing questions:

    k. What components go into making an elevator that you didn't know were there?

    l. What was the most challenging part of making your elevator, and why?

    m. If you could change one thing on your elevator, what would it be and why?

    n. Why are elevators important in modern buildings?

    o. What role do they play in ensuring that amazing spaces, like Edge, are accessible to all people?

## Activity 3: My Point of View

We think of glass as a fragile material, but it is now used to construct some of the strongest buildings in the world. How can we use glass to re-imagine the buildings in our own communities?

### OVERVIEW

Edge is the tallest outdoor sky deck in the Western hemisphere and part of its floor is made of glass! It's 100 stories up in the sky and on a clear day it provides an 80-mile, 360° view of New York City and the surrounding area.

# REACH FOR THE SKY

In this activity, students will explore the many ways glass has been used in the construction of Edge. They will think about why architects placed glass in some of the spaces that they did, including the floor, and how it provides for some surprising, thrilling views. Finally, they will select an unused space in their community where a sustainable development, like Hudson Yards, could be built. How could this development provide an area of enjoyment and awe, like Edge? How could glass be used to strengthen their space and provide incredible visitor experiences? Students will draw a sketch or prototype of their development and the view that visitors would experience. Finally, students will present their designs to one another in a pitch competition that simulates a presentation a real estate developer might give.

## TIME

45 minutes

## MATERIALS

- Access to the Discover Edge website (to be projected in front of the classroom)
- **My Point of View** student capture sheet
- Drawing Utensils (colored pencils, crayons, markers, etc.)

## INSTRUCTOR NOTES

1. Begin by projecting the Discover Edge website on your classroom screen.
2. Click on each of the menu items located on the webpage: Discover Edge, 360° Views, Outdoor Sky Deck, Angled Glass Walls, The Skyline Steps and The Eastern Point.
    - Teacher's Note: Omit The Champagne Bar for the purposes of this classroom activity.
3. As you click on each menu item, pause and read the text that appears on the screen. Be sure to click on each of the white beacons that appear on the page that highlight specific areas of the Sky Deck.
4. When you have completed the website walkthrough, divide students into pairs. Provide pairs with five minutes to discuss the following questions:
    a. Have students ever visited a building with an experience like the outdoor sky deck? Where was the building and what was it like? What makes the sky deck, at Edge, with its angled glass walls so different?
    b. What are some considerations you think the architects and engineers had when designing Edge?
    c. Why is it important that modern buildings like Edge consider sustainability and make efforts to limit their impact on the environment?
5. Once the five minutes have elapsed, invite a few student pairs to share their responses.
6. Explain that Edge is a part of Hudson Yards, the largest private real estate development project in American history. As part of that project, the engineers and architects utilized a variety of socially and environmentally-conscious practices, such as:

   a. Designing green areas with species native to Manhattan
   b. Achieving LEED gold neighborhood status
   c. Building a state-of-the-art microgrid that recycles energy generated by the buildings

7. Invite students to think about an unused area in their community that could benefit from a green redevelopment project like Edge.
8. Distribute one copy of the **My Point of View** student capture sheet to each student. Read through the instructions, highlighting that they will present their sketches in front of the class when they are finished. This presentation should mimic a pitch presentation a real estate developer would give.
9. Provide students with 15 minutes to sketch their design prototype. When students are finished, invite them to the front of the class to pitch their redevelopment ideas. As students present, encourage their classmates to record the following elements of feedback on an index card for each presentation:
   a. One thing I liked was...
   b. One question I had was...
   c. What if you tried...
10. When each student has finished presenting, instruct them to pass their index cards to the appropriate presenters.
11. Direct students to revise their designs using the feedback given by their peers.
12. Consider having students present their ideas to community stakeholders.

## NATIONAL STANDARDS

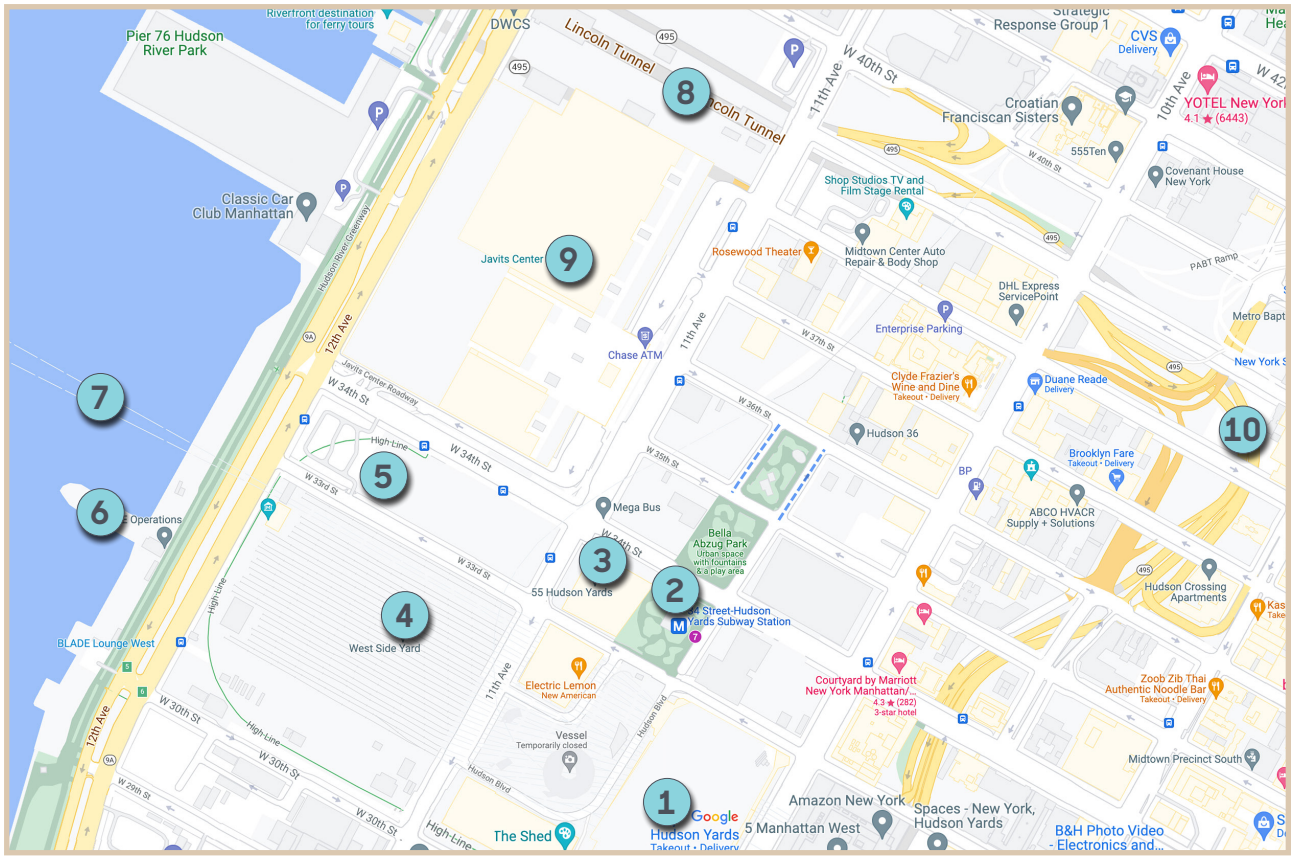
- **MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]
- **MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.** [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]
- **MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]
- **MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
- **MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**
- **MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**
- **MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*** [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

- **MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.** [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]
- **MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]
- **MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.** [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]
- **MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.** [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

## INSTRUCTIONS

1. Divide into groups.
2. With your group and using a device connected to the internet, identify each of the locations numbered on the map below. Write the name of each location in the corresponding space in the chart.
3. Once you have identified the name of each location and written it in the space in the chart, look up the location and identify at least one way that steel was used in the construction of the location.
4. Then, research the location to see where and how the steel was manufactured. Develop a best-guess estimate of the environmental impact of the steel processing that went into making that site.
5. Finally, using this webpage about the sustainability practices in place at Hudson Yards, identify two ways the site could offset the environmental impact it made through the steel manufacturing process.




Map data ©2021 Google

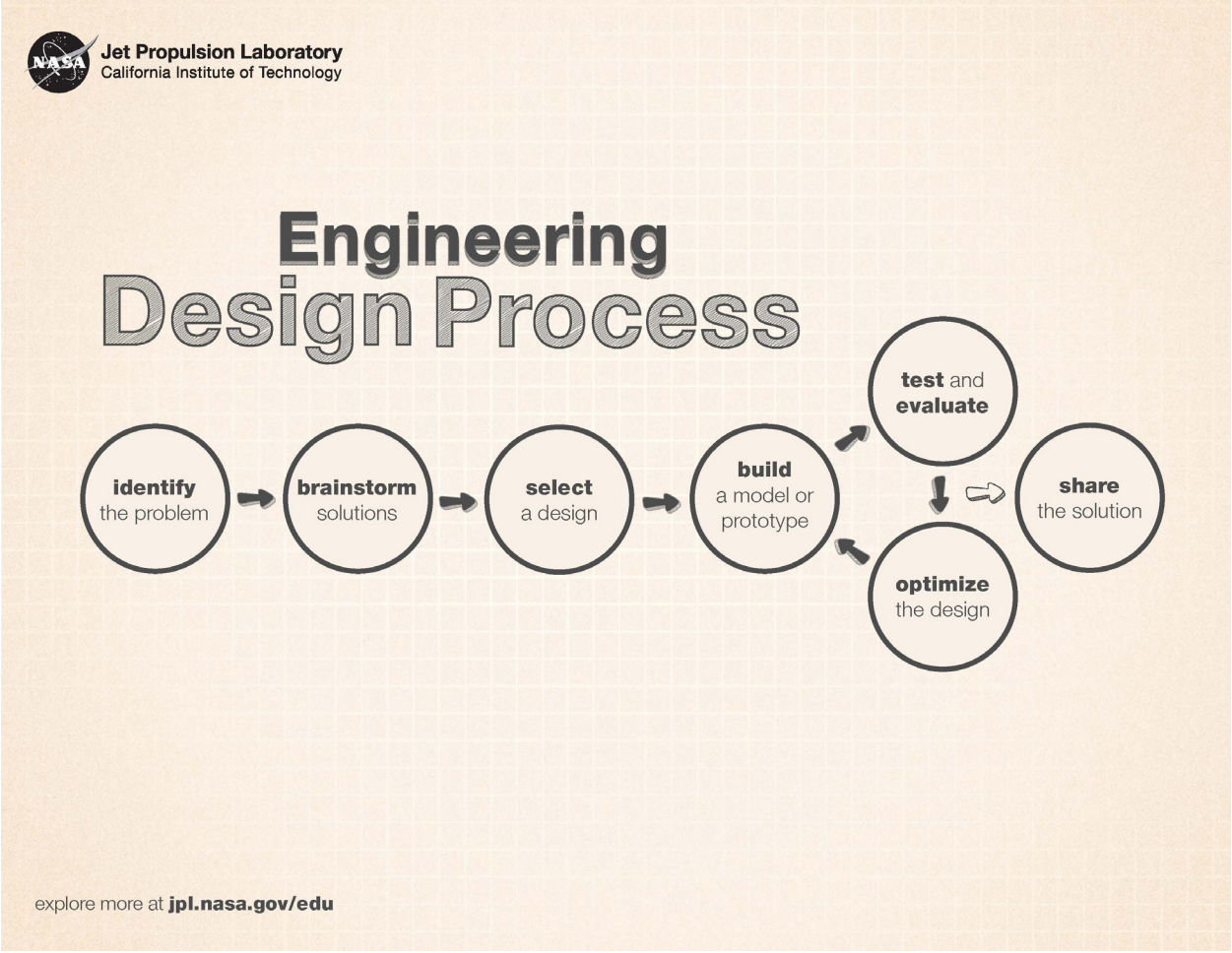
# DECONSTRUCTING STEEL—2 OF 2

| Number | Location Name | Steel Use | Manufacturing Technique | Environmental Impact (Low/Medium/High) | Two Ideas to Offset Carbon Footprint |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |

| Number | Location Name | Steel Use | Manufacturing Technique | Environmental Impact (Low/Medium/High) | Two Ideas to Offset Carbon Footprint |
|---|---|---|---|---|---|
| 1 | Hudson Yards, the Shops and Restaurants | | | | |
| 2 | 34th Street/Hudson Yards Subway | | | | |
| 3 | 55 Hudson Yards: Corporate Office | | | | |
| 4 | West Side Yard | | | | |
| 5 | The High Line | | | | |
| 6 | West 30th Street Heliport | | | | |
| 7 | NJ Transit (alternate answer: Ferry) | | | | |
| 8 | Lincoln Tunnel | | | | |
| 9 | Javits Center | | | | |
| 10 | 495 Overpass | | | | |

## INSTRUCTIONS

1. Use the Engineering Design Process to construct a functioning model of an elevator. The elevator must meet the following criteria and constraints:
    a. It must have a motor
    b. It must have a car that can hold 100 grams
    c. It must have a shaft
    d. It must have a cable
    e. It must have a stopping mechanism
2. Use the materials at the front of your classroom to build your model.
3. As you work through the process, record your observations next to each step of the Engineering Design Process outlined below.



# MY POINT OF VIEW



## INSTRUCTIONS

1. Think about an unused area of your community that would benefit from a development project like Edge. Write the name of the area here: _____
2. Now, sketch a model of what your project might look like. Consider what you learned from Edge, as you sketch your prototype:

3. Outline five specific areas of your sketch that you would highlight in a presentation. Remember, you will be pitching your idea to your class. Make sure you include why your development would be awe-inspiring and make an impact on your community.

    1.
    2.
    3.
    4.
    5.

4. Present your sketch to the class, being sure to highlight the five areas above. This presentation should be persuasive, like a presentation a real estate developer might give to a client!
5. As you present, your classmates will write down feedback on an index card. When you finish your presentation, they will provide their feedback. Revise your sketch using the feedback you receive.
6. With the support of your teacher and parents, consider sharing your revised prototype with community stakeholders, like your local city council.