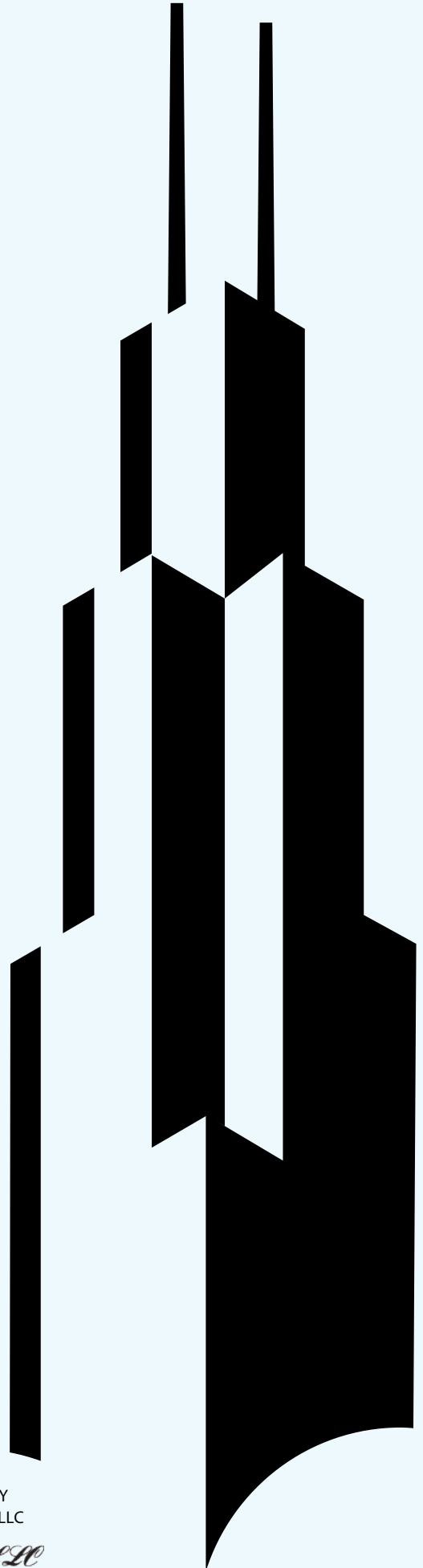


THE HOWS, WHATS AND WOWS OF THE WILLIS TOWER

A GUIDE FOR TEACHERS
SKYDECK CHICAGO



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U.S. Equities Asset Management, LLC

WELCOME TO SKYDECK CHICAGO AT WILLIS TOWER

THE NATION'S TALLEST SCHOOL

There are enough impressive facts about the Willis Tower to make even the most worldly among us say, "Wow!" So many things at the Willis Tower can be described by a superlative: biggest, fastest, longest. But there is more to the building than all these "wows": 1,450 sky-scraping, cloud-bumping feet of glass and steel, 43,000 miles of telephone cable, 25,000 miles of plumbing, 4.56 million square feet of floor space and a view of four states.

Behind the "wows" are lots of "hows" and "whats" for you and your students to explore. In this guide you will be introduced to the building—its beginnings as the Sears Tower and its design, construction and place in the pantheon of skyscrapers. Its name was recently changed to the Willis Tower, proudly reflecting the name of the global insurance broker who makes the Tower its Chicago home. You will also learn about the Skydeck view of Chicago, a view unlike any other anywhere.

Included are other sections geared to the interests of your students and the needs of your curriculum, such as art, environmental efforts and our "city within a city."

At the end are "Try This" activities and discussion questions that relate to each section. We have used several of them to create "Come Rain or Come Shine" field trip plans to adapt for all ages. Please choose among the activities to fit your students.

When you get back to your school, we hope your students will send us photos or write or create artwork about their experiences and share them with us (via [email](#) or the mailing address at the end of this guide). We've got 110 stories already, and we would like to add your students' experiences to our collection.

One photo will be selected as the "Photo of the Day" and displayed on our Skydeck monitors for all to see. Artwork and writing will be posted on bulletin boards in the lunchroom area. Your students also can post their Skydeck Chicago photos to the Willis Tower or Skydeck Chicago pages on flickr, a free public photo-sharing site: <http://www.flickr.com/photos/tags/willistower/> or <http://www.flickr.com/photos/skydeckchicago/>.

As you get ready for your trip, please call us with any questions at (312) 875-9447. We aim to make your visit to the Nation's Tallest School your best school trip ever.



A TOWER OF THE PEOPLE.

—Bruce Graham, lead architect, Sears Tower (now known as the Willis Tower)

IN THIS GUIDE

A SKYSCRAPER AMONG SKYSCRAPERS

The Skyscraper That Almost Wasn't	4
The First "Sears Tower"	5
Where Does the Willis Tower Rank Among the World's Tallest Buildings?	5
Skyline of the World's Tallest Buildings	6

DESIGNING AND CONSTRUCTING THE WORLD'S TALLEST BUILDING

A Thumbnail History of the Skyscraper	7
Meeting the Design Challenges	8
The Tower Takes Shape	9
From the Ground Up	10
Sears Tower to Willis Tower: Timeline	11

ART AND ARTISTRY AT THE WILLIS TOWER

Our Front Door	12
Our Indoor "Universe" by Alexander Calder	12

OUR CITY WITHIN A CITY

The Vertical Village	13
Down Under	13

THE WORLD FROM THE TOP

Everything Is at Your Feet	14
How Many Different Languages Do You Hear?	15
Walking on Air: The Ledge	16

HOW IT ALL WORKS: SAFETY, SYSTEMS AND MAINTENANCE

The Command Center	17
Safety at the Willis Tower	17
People and Places	17
Electricity, Plumbing and Phone Service	18
All the Ups and Downs	18
Keeping Cool and Staying Warm	19
Washing the Outside	19

ENVIRONMENTAL EFFORTS AT THE WILLIS TOWER

Reducing, Reusing and Recycling	20
The Shrinking Carbon Footprint	20
How the Willis Tower Reduces Waste	21
What's Recycled at the Willis Tower	21
What's Thrown Away at the Willis Tower	21
A New Kind of Heat Exchange	21
Our Fine Feathered Hunters	21

ACTIVITIES AND QUESTIONS FOR STUDENTS

Try This: Spot the Willis Tower on Your Way into Chicago	22
Role-Play This: What Problems Must You Solve to Build a Tower This High?	22
Calculate This: How Many "Yous" Would Have to be Stacked Head to Toe to Equal the Height of the Willis Tower?	22
Discuss This: What Do the Shapes Mean?	22
Design This: Make Your Own "Universe"	22
Consider This: What Business Would You Include in the Willis Tower?	23
Dare This: Walk Out on The Ledge	23
Picture This: Try Collaborative Photography to Create a Panoramic View	23
Discuss This: What Would It Be Like to "Fly Blind?"	23
Try This: Create Your Own Souvenir	24
Figure This: How Long Is Your Elevator Ride?	24
Try This: Help the Environment at Your School	24

YOU AND THE VIEW ACTIVITY SHEETS

Find This Outside: Landmarks to Locate by Day	25
Find This Outside: Landmarks to Locate by Night	26
I Spy on High	27
Indoor Scavenger Hunt: Look, Listen and Interact!	28

"COME RAIN OR COME SHINE" FIELD TRIP PLANS

Start Every Trip This Way	29
Sunny Day Trip	29
Clear Evening Trip	30
Rainy Day/Rainy Evening Trip	31

FOR MORE INFORMATION: AN ANNOTATED BIBLIOGRAPHY

Books	32
Videos on DVD/VHS	33
Online Resources	34
Software	35

MORE ABOUT YOUR TRIP

Getting Here	36
Local Map/Bus and Automobile Parking	36
Entering Skydeck Chicago	36
Accessibility	36
Meals and Snacks	36
Numbers to Know	36
Hours	36



A SKYSCRAPER AMONG SKYSCRAPERS

Look at any photograph of Chicago, and there it is: the Willis Tower. This building, formerly known as the Sears Tower, says Chicago in the same way the Eiffel Tower says Paris and the Empire State Building says New York.

The tallest building in the Western Hemisphere, the Willis Tower stands out from the rest of the city's skyline, even though Chicago includes some of the most spectacular architecture anywhere. As architecture critic Paul Goldberger put it a few years ago, "What brownstone has ever been the symbol of New York that the Empire State Building is, what lakefront park the icon that the Sears Tower has become?"

Yet if the Sears, Roebuck Co. had followed through on its initial thoughts for a new office building, the Willis Tower would have been less of, well, a tower. And the city would have lost its most recognizable landmark.

THE SKYSCRAPER THAT ALMOST WASN'T

Planning for new office space for the Sears, Roebuck Co. began in the late 1960s, when Sears was generating 1 percent of the annual value of all the goods and services produced in the nation, according to *The Sears Tower* by Craig and Katherine Doherty. A huge company needed a huge headquarters. The company figured it would need enough room for more than 13,000 Chicago-area employees to meet its projected growth through the end of the century.

After interviewing many architects, Sears hired Skidmore, Owings & Merrill, the architecture firm that recently had completed Chicago's John Hancock Center. The team included Bruce Graham as lead architect and Fazlur Khan as structural engineer, a man later called the "Einstein of Structural Engineering."

THE TALL BUILDING IS THE LANDMARK OF OUR AGE.

—Ada Louise Huxtable

Sears envisioned a building with enormous floors, some of which would be rented out to other businesses before Sears needed them for its own employees. Indeed, the first plan would have made the Sears “tower” 40 stories of 110,000 square feet each. This would have been just fine for Sears, but not for the other, much smaller businesses Sears had hoped would rent space.

Each new plan called for an increasingly vertical design, offering more floors with less space. When the building design finally called for 104 stories, someone suggested that only six more would create the world’s tallest building at 110 stories. Thus, a skyscraper among skyscrapers—and the icon of Chicago—was conceived.

WHERE DOES THE WILLIS TOWER RANK AMONG THE WORLD’S TALLEST BUILDINGS?

The Willis Tower is #1 in height in the nation and Western Hemisphere and #6 in the world. According to the Council on Tall Buildings and Urban Habitat, a building’s height can be measured in several different ways. The Willis Tower qualifies as the tallest building in the nation in:

- » Height to highest occupied floor (1,431 ft.)
- » Height to the top of the roof (1,450 ft.)
- » Height to the top of spire or antenna (1,730 ft.)

While the Willis Tower is no longer the tallest building in the world, it does have the globe’s longest elevator ride. You are whisked up 1,353 feet to the highest building observation deck on Earth. Unless, of course, you want to quibble over that point with Toronto’s CN (Canadian National) Tower, which is not exactly a “building” but a 1,815-foot high “self-supporting structure.” Its observation deck is 1,465 feet off the ground.

THE FIRST “SEARS TOWER”

When business partners Richard Sears and Alvah Roebuck decided to build the first national headquarters for the Sears, Roebuck Co. in 1905, they looked to the skies.

The first “Sears tower” stood 12 stories high, overlooking the neighborhood around Homan and Arthington Roads in northwest Chicago. Originally designed as a water tower, the 250-foot-high structure in 1924 became a broadcasting studio for a Sears-owned radio station, WLS, whose call letters stood for “World’s Largest Store.” A year later, the company opened its first retail store in the brick complex adjacent to the tower. Sears Holdings, one of the nation’s largest retailers, continues to bear the famous name.



MY KIND OF TOWN, CHICAGO IS.

—Frank Sinatra

SKYLINE OF THE WORLD'S TALLEST BUILDINGS

SKYSCRAPERS

Burj Dubai | Dubai, United Arab Emirates
Completed 2009 | 2,682 feet (818 meters) tall

Willis Tower | Chicago, United States
Completed 1973 | 1,730 feet (527.3 meters) tall

Taipei 101 | Taipei, Taiwan
Completed 2004 | 1,671 feet (509.2 meters) tall

Shanghai World Financial Center | Shanghai, China
Completed 2008 | 1,614 feet (492 meters) tall

Petronas Towers | Kuala Lumpur, Malaysia
Completed 1998 | 1,483 feet (451.9 meters) tall

Jin Mao Tower | Shanghai, China
Completed 1998 | 1,380 feet (420.5 meters) tall

2 International Finance Center | Hong Kong, China
Completed 2003 | 1,364 feet (415.8 meters) tall

CITIC Plaza | Guangzhou, China
Completed 1997 | 1,282 feet (391.1 meters) tall

Shun Hing Square | Shenzhen, China
Completed 1996 | 1,260 feet (384 meters) tall

Empire State Building | New York, United States
Completed 1931 | 1,472 feet (448.7 meters) tall

DESIGNING AND CONSTRUCTING THE WORLD'S TALLEST BUILDING

A THUMBNAIL HISTORY OF THE SKYSCRAPER

The first skyscrapers were built about a century ago. Driving the need for ever and ever larger buildings were the growing businesses of America. But the only way to remain in the center of cities—near the rails, ports and customers that businesses needed—would be to grow up, and not out, in size.

Two innovations made the quest for the sky possible: the steel frame and the elevator. Making buildings with steel skeletons—or steel-reinforced concrete—to bear the weight made it possible to reach up beyond 15 or 20 stories. One of the last tall buildings with load-bearing walls was built in 1891, the 16-story Monadnock Building in Chicago. Its seven-foot-thick walls bore the weight of all the floors above. A building with load-bearing walls to handle the weight of a 60-story building would have to be so thick on the bottom floors that there would be no room for office space.

The perfection of the safety elevator by Elisha Otis made it much more appealing to build taller buildings. What seems at first consideration to be a luxury is a necessity. No one wants to climb steps to a 40th floor, much less to a 110th floor (more than 2,232 steps up!).



MEETING THE DESIGN CHALLENGES

The challenge of building the world's tallest building is contending with two forces of nature: gravity and wind. One, of course, is a vertical force and the other, horizontal.

The solution to both in the Sears Tower was an elegant design that had the serendipitous result of being cost-effective as well. Fazlur Khan, the structural engineer from Skidmore, Owings & Merrill, already had figured out how to build 100 stories at the John Hancock Center. For that building, he used a steel tube with exterior cross braces instead of the traditional steel skeleton of most skyscrapers.

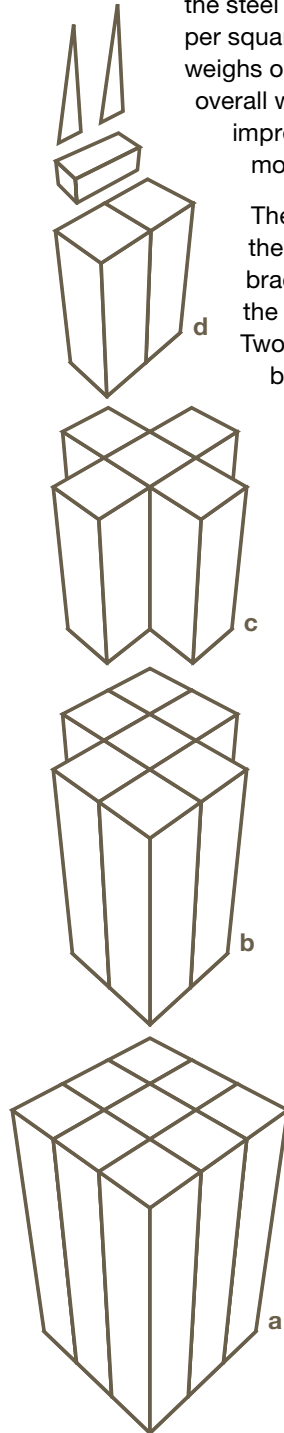
But to go still higher and create a distinctive look for the Tower, Khan came up with a “bundled tube” design that handled both wind and gravity. At the ground level and on up to the 50th level, the building is nine tubes of rigid steel column-and-beam construction. Each measures 75 feet by 75 feet, yielding 50,000 square feet of space per floor. If you look at the side of the Tower at the ground level, each side is three tubes wide (see **a**).

At the 50th level, two of the tubes—on the northwest and southeast corners—end (see **b**). At the 66th floor, two more tubes—this time on the northeast and southwest corners—end (see **c**). The remaining five tubes—forming a plus sign with one in the middle and one on each side—stretch together to level 90, where three more tubes end. (see **d**). The last two reach the 109th floor. This is the floorplate you will experience when you visit the 99th and 103rd floor Skydecks. The 110th floor is a small penthouse structure housing one of the wash robots that helps keep the outside of the building clean.

Using the 75-foot tubes cut both the potential weight and cost of the building. If the Sears Tower had been built as a traditional skyscraper, the steel would have weighed about 50 pounds per square foot. The steel used in Khan's design weighs only 33 pounds per square foot. The overall weight of the steel frame, however, is still impressive: 76,000 tons, or enough to build more than 52,000 cars.

The variations in the tube heights disrupt the force of the wind. Interior cross braces on several floors also help stiffen the building to make it more windproof. Two models were tested in wind tunnels before the design was made final and construction began. The final building was designed to sway up to 6 inches in the strongest winds.

The final design also solved another problem facing the architects: how to allow tenants of different sizes to use the building efficiently until Sears was ready to occupy the whole building. The final design allowed Sears to take the larger, lower floors and lease the smaller, upper floors to tenants.



THE TOWER TAKES SHAPE

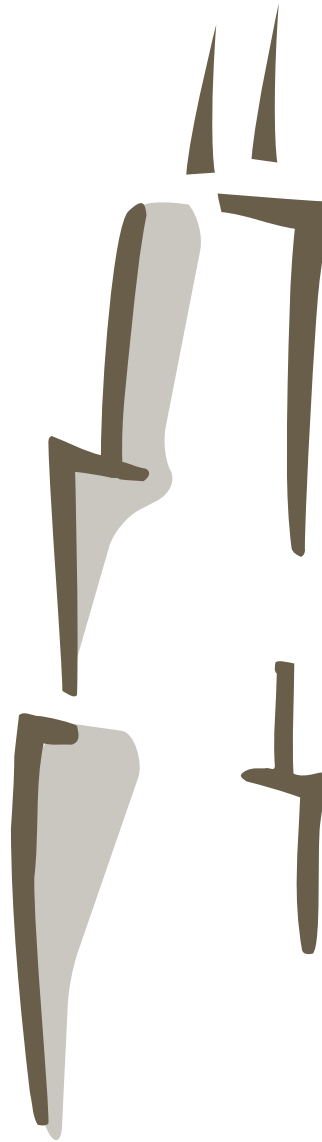
The Sears Tower took roughly three years and \$175 million to build. The builders broke ground in August 1970 and set the first section of steel for the bundled tubes in place in June 1971.

Starting with a hole 100 feet deep, builders laid the foundation of 200 circular caissons set into the bedrock. Prefabricated steel in 15-foot by 25-foot sections—called “Christmas trees”—were put into place, rising at a rate of about two floors a week. Four derrick cranes moved higher with each floor to lift the “Christmas trees” into position.

The builders put enough concrete into the building to make an eight-lane highway five miles long. Some 2 million cubic feet of concrete went into the foundation and all of the floor slabs. Special elevators were created to take the concrete mixed on site to heights above.

When it took too much time for workers on the upper floors to go down and eat their meals at ground level, special kitchens were created to feed them on two floors part way up. They endured temperatures up to 20 degrees colder at the top than at ground level. Practically the only thing that could stop construction was the wind, which blew so hard at the highest points that the workers could not even stand up, much less move across the beams.

By May 3, 1973, the last beam was put into place. It was signed by 12,000 construction workers, Sears employees and Chicagoans who wanted their names on the world’s tallest building, a title the Sears Tower would hold for 23 years.



SHE TOWERS SO HIGH.

— Sears Tower workers singing as they put the last beam in place

FROM THE GROUND UP

A Giant Footprint Is a First Step

Such a tall building needs a good-sized place to sit. How about three acres in downtown Chicago? Fifteen smaller buildings on two city blocks were razed for the Tower. And a section of Quincy Street—bought from the city of Chicago for \$2.7 million—was swallowed up. All of the real estate was in Sears' hands about nine months before ground was broken for construction to begin in the summer of 1970.

Underneath It All

Supporting the millions of square feet of floor area in the Willis Tower are deep concrete bedrock caissons. Each of the Tower's nine tubes extends down three levels where it is connected to circular foundation supports anchored in limestone bedrock. The foundation supports are all connected to a huge concrete raft that acts as the lowest basement floor. The 30-inch thick concrete wall around the concrete raft keeps the basement dry. Even when hundreds of building basements in the Chicago Loop flooded with Chicago River water in 1992, the Tower's basement stayed dry.

Tell Me a Story

A story, sometimes spelled storey, is the space between one floor and the next. The height of one story at the Willis Tower is 14 feet, but the average ceiling height on a typical office floor is about 8 feet, 8 inches. The rest is taken up by mechanicals such as heating, cooling and electrical systems.

The Willis Tower has 110 stories, with the first story being at the Franklin Street plaza level. Three more levels extend 48 feet underground below Franklin. Basement and attic floor levels usually are not considered to be stories.

On the Sides and at the Center

When you look at the Willis Tower, you notice the huge number of windows. Across the face of the entire building are 16,100 tinted windows and 28 acres of black aluminum panels (with the color chosen to hide the city's dirt). The building glows bronze at certain times of day, depending on how the sun hits it.

These windows and panels make up the curtain wall, or exterior, of the building. At the center of the bundle of tubes are the elevator banks, washrooms and areas on each floor for the plumbing, electrical wires and heating and cooling apparatus. The people working in the offices need the best views.

Over Your Head

At the very top of the building are 287-foot antennas with airline warning strobe lights that flash 40 times a minute. Visible to pilots over great distances, the lamps are changed about every 18 months by a climber who scales the antenna towers. New digital antennas were recently installed for Chicago's major television stations so they could offer high-definition TV.

In the past, the antenna towers also have served as lightning rods, with grounding cables running from the top down to the ground, where electrical energy is safely dissipated. More recently, the antennas have featured a spiked circular lightning deterrent system, which prevents static electricity from building up and being discharged as lightning.

FROM THE BEGINNINGS OF THE SEARS TOWER TO TODAY'S WILLIS TOWER

- 1886** Richard Sears sells watches by mail order.
- 1887** Sears hires Alvah Roebuck to repair the watches he sells.
- 1893** Sears and Roebuck become partners and move to Chicago.
- 1906** Sears and Roebuck move to Homan and Arthington Roads on Chicago's northwest side, where the first Sears Tower—a water tower—is a neighborhood landmark.
- 1925** Sears and Roebuck open their first retail store there.
- 1969** The world's largest retailer, Sears, Roebuck Co., purchases 3 acres of land to create a new headquarters.
- 1970** Design of Sears Tower is unveiled in July. Ground is broken for the Sears Tower in August.
- 1971** First steel is erected in June.
- 1973** Last steel is put into place in May. First Sears employees move into the Tower in September.
- 1982** Public areas are renovated. New antenna sections are added to make present total Sears Tower height of 1,730 feet.
- 1988** Sears moves out of the building.
- 1990** Lobbies and public areas are renovated. The Skydeck pavilion is created.
- 1994** Aldrich, Eastman, and Waltch become owners of the Sears Tower.
- 2000** The 103rd floor Skydeck is renovated. It now provides not only a great view, but also a fabulous overview of Chicago's history.
- 2004** The Tower is purchased by 233 S. Wacker Drive LLC, a real estate group formed to buy the building.
- 2007** U.S. Equities Realty becomes the building's exclusive leasing and management company.
- 2009** All of the Skydeck entry areas are revitalized to bring the city of Chicago to life even before people take the trip to the 103rd floor. There are exciting new interactive exhibits about Chicago favorites, from the museums to sports (and don't forget the hot dogs and deep dish). The 103rd floor Skydeck gets an exciting new feature—The Ledge—that lets you stand 4.3 feet away from the side of the building on a 1.5-inch glass floor high above Wacker Drive and look below, above, front and side to side. It's like you are in a bubble floating 103 stories high above the bustle below. The building is named the Willis Tower after the Willis Group, a London-based global insurance broker.



ART AND ARTISTRY AT THE WILLIS TOWER

OUR FRONT DOOR

The public areas of the Willis Tower, redesigned by Chicago architects DeStefano and Partners in the 1980s, draw your attention to the construction of the building.

The beams and columns of the tube at the Wacker Drive front entrance are clad in lavishly decorated brushed and polished stainless steel. Italian Travertine marble creates a rich yet neutral backdrop. The elevators are polished so shiny that they are mirrors.

Inset into the large red granite floor tiles are stainless steel medallions of varying sizes. The medallions are representations of the construction of the building. See for yourself!

In the warm months, planters are filled with flowering plants both inside the lobby and out. The red granite plaza outside features seasonal outdoor seating and is often filled with people enjoying the sunshine, listening to the summer concert series or picking up fresh produce from the farmers market. In December, an enormous decorated evergreen tree graces the Wacker Drive lobby.

The Skydeck entrance pavilion off of Jackson Boulevard is a light-filled area that beckons to the thousands of visitors who stop by every day. You may even see the 20-foot-high Willis Tower built entirely from LEGO® bricks by our visitors (see page 27 for details).

OUR INDOOR “UNIVERSE” BY ALEXANDER CALDER

The whole “Universe” is contained in the lobby of the Willis Tower.

Enter from Wacker Drive, and you step down to the four-story atrium at whose center is “Universe,” a kinetic sculpture designed by Alexander Calder (1898-1974), a noted American sculptor.

This massive sculpture features seven elements, each of which is driven by its own motor at its own speed. In red, yellow, blue and black are three flowers, a spine, a helix, the sun and a pendulum.

The total composition weighs 16,000 pounds and stretches 55 feet wide and 33 feet high. It was prefabricated in a foundry in France before being brought to this country for installation in 1974 in the Willis Tower lobby. Calder, an engineering draftsman before he became an artist, flipped the switch himself to begin the movement of the sculpture.

OUR CITY WITHIN A CITY

THE VERTICAL VILLAGE

With more than 4.5 million square feet of space, the Willis Tower is a “vertical village.”

Imagine a city the size of 78 football fields, including the end zones, and you have an idea of how large the Tower’s space is. The only larger office building in the world is the Pentagon, the U.S. military’s headquarters just outside Washington, D.C.

More than 25,000 people a day come through the doors on their way to work or to visit the Skydeck or one of the many businesses in the building. While the Willis Tower is home to many different kinds of businesses, it has been especially attractive to companies in insurance (including the namesake Willis Group), health care, law and accounting.

With hundreds of thousands of pieces of mail coming in each year, the Willis Tower has its own U.S. Post Office. There are numerous restaurants, from a coffee shop to fine dining. You can handle just about all of your day-to-day needs, such as getting breakfast, lunch and dinner, working out, doing your banking, getting a haircut and buying a gift or book or other sundries. And you can visit your doctor, chiropractor, broker or lawyer. All without going outside!

DOWN UNDER

The first lower level of the Willis Tower is where all of the “stuff”—the mail, the furniture, the equipment, the food for the restaurants, you name it—comes into the building.

Fifteen loading and unloading bays handle all the vehicles bringing material to and from the building. Trucks and delivery vehicles enter from Lower Wacker Drive, which runs underneath South Wacker Drive, just in front of the building. Some 200 cars can be parked underneath the building at one time.



... SHOW ME ANOTHER CITY ... SO PROUD TO BE ALIVE ...

—Carl Sandburg, poet, in “Chicago”

THE WORLD FROM THE TOP

EVERYTHING IS AT YOUR FEET

On a clear day, you can see up to 50 miles from the top of the Skydeck into four states: Illinois, Indiana, Michigan and Wisconsin.

The lake sparkles to the east, and the roads in and out of Chicago are filled with travelers. Nightfall brings a different glittering view to the Skydeck, and everything seems closer. There's no better view anywhere.

South

Peer south and enjoy views of some of Chicago's favorite attractions—from historic Soldier Field to the Field Museum and the Museum of Science and Industry. On a clear day, you may even spy the smokestacks around the bend of Lake Michigan that mark the industrial city of Gary in neighboring Indiana.

Look for:

- » The Field Museum
- » Soldier Field
- » McCormick Place
- » Hyde Park
- » The Museum of Science and Industry

East

Look east and feast your eyes on the stunning view of one of the world's largest freshwater lakes, Lake Michigan. The land along this truly great lake is home to beautiful parks and cultural attractions, including Millennium and Grant parks, the Shedd Aquarium and the Adler Planetarium. Due east, across the water you just might see the shore of Michigan.

Look for:

- » Aon Center
- » Navy Pier
- » Millennium Park
- » Grant Park
- » Buckingham Fountain
- » Shedd Aquarium
- » Adler Planetarium
- » Northerly Island

North

To the north, you will see many of the other notable skyscrapers that help make up Chicago's iconic skyline. You also will see the Chicago River, Lincoln Park Zoo and world-famous Wrigley Field. Look to the horizon and you will start to see how the city's growth has bridged the border to blend with the cities of southern Wisconsin.

Look for:

- » Wrigley Field
- » Lincoln Park Zoo
- » Merchandise Mart
- » John Hancock Center
- » Water Tower Place



West

Looking west, you will see the constant air traffic of O'Hare and Midway airports. The west side of the city is also home to renowned University of Illinois' Chicago campus, the United Center, Oprah's Harpo Studios and historic Little Italy and Greektown. But the true highlights of the western view are the spectacular sunsets and The Ledge with its unbelievable views straight down 1,353 feet.

Look for:

- » Midway Airport
- » Little Italy
- » University of Illinois Chicago Pavillion
- » Greektown
- » United Center
- » Harpo Studios
- » O'Hare Airport

HOW MANY DIFFERENT LANGUAGES DO YOU HEAR?

The Skydeck draws 1.3 million visitors a year, many from around the world. Listen as you take the elevator and walk around the Skydeck. How many different languages do you hear being spoken? If you're at the Skydeck on a big tour day, you'll think the United Nations has moved to Chicago.

WALKING ON AIR: THE LEDGE

The Skydeck's newest view surrounds you: above, below, to the sides and right in front of you. The Ledge boxes extend 4.3 feet from the Tower itself and stand 1,353 feet above Wacker Drive. Look between your feet and see the people walking below. Look straight down the Chicago River. There is nothing like it anywhere. Exhilarating, exciting and scary—all in one.

The inspiration for The Ledge came from the hundreds of forehead prints visitors left behind on Skydeck windows every week. From the memorable scene in the movie "Ferris Bueller's Day Off" to curious children going right up to the window, visitors are constantly trying to catch a glimpse below. Now they have a unique and unobstructed view of the city.

The Chicago office of Skidmore, Owings and Merrill, the building's original designers, drew up the innovative plans for this architectural and engineering achievement. The Ledge is designed so that the fully enclosed glass boxes rest between conveyer belts. The boxes retract into the building, allowing easy access for cleaning and maintenance.

Experts in international structural glass design, Halcrow Yolles, fully designed and detailed all the glass and steel components. Beginning with the architect's original concept, the engineers took the design one step further by eliminating all perimeter structural steel at the sides and along the floor of the glass enclosures and creating a near-invisible support system.

MTH Industries, the Chicago-based 120-year-old glass and architectural metal contractor that installed Cloud Gate in Millennium Park, installed The Ledge's glass panels. Each glass box is comprised of three layers of glass laminated into one seamless unit. The low-iron, clear glass is fully tempered and heat-soaked for durability. In addition, the motorized system that projects and retracts the boxes from the building utilizes steel LinearBeams. The result is both beauty and strength.

SKYDECK LEDGE

HOW IT ALL WORKS: SAFETY, SYSTEMS AND MAINTENANCE

THE COMMAND CENTER

The Willis Tower is fully automated. A command center helps the building engineers and security staffers keep watch over the building. A huge bank of screens relays images from cameras located in all the public areas of the building. Another set of screens monitors all of the systems that keep the building heated and cooled, the water running and the electricity humming.

Command center staff can tell the temperature of each floor and the electricity being used as well as which elevators are in use and where they're going. All of the images and data are recorded.

Office workers who want the temperature a little cooler or a little warmer can just call the command center for assistance.

SAFETY AT THE WILLIS TOWER

Safety is top priority at the Willis Tower. Every system has been designed for the safety of the people who work in and visit the building.

Security personnel are on duty 24 hours a day, monitoring the building in the command center and patrolling the public areas. Guards are posted at the loading docks, the public areas, the Skydeck and throughout the building.

The Willis Tower was the first building to have automatic sprinklers covering every square foot of space. In addition, all of the steel is fireproofed. Advanced smoke detectors on every floor can pinpoint the source of any smoke and alert a computer in the command center that activates the exhaust system for that area and reduces the flow of air that might fuel a fire. There also are fire pumping stations at many levels and four stairwells for use in case of fire.

While earthquakes are unlikely in the Chicago area, the Willis Tower is capable of resisting significant earthquake forces. The closely spaced columns built to withstand high winds also would give the building great strength in an earthquake.

If there were a power failure, two diesel generators would provide emergency power for the elevators and lights. (The building has never experienced a blackout in its entire history.) There is a public address system throughout the building and hotlines to both police and fire stations.

Even the sidewalks are heated to keep snow and ice from building up and posing a hazard to passersby and people heading into the building.

PEOPLE AND PLACES

Keeping a building of this size running smoothly takes a lot of machinery and an army of people working around the clock.

The building employs a platoon of security guards, 99 full-time housekeepers, 28 maintenance engineers, six electricians, six technicians, five elevator technicians, three carpenters and a locksmith. Contractors also are used for special jobs.

Each floor has some machines and equipment, but the major pieces are housed in "physical plants" on seven floors. These floors feature electrical substations, water- and air-handling equipment and elevator motors. In addition, some of these floors feature cross bracing for the tubes. You will notice some of these floors from the outside, as some of them have louvers (or slotted covers) instead of windows.

ELECTRICITY, PLUMBING AND PHONE SERVICE

The power for the Willis Tower comes through a 13,200-volt substation. Some 2,000 miles of cable—enough to reach from Chicago to Los Angeles—carry enough electricity throughout the building to serve a town of about 35,000 people. Eight o'clock means lights out for the building, except where tenants are still working and the cleaning crews are doing their jobs.

Turning off the lights is important when the building's electrical bill is millions of dollars a year. No wonder: the building features some 145,000 light fixtures and other electrical installations!

Fitting restrooms throughout the building took 25,000 miles of plumbing. There are 992 toilets. When you wash your hands, you are using one of 796 washroom faucets in the building.

The phones required 43,000 miles of telephone cable, enough to circle the globe one and three-quarters times.



ALL THE UPS AND DOWNS

One-hundred-and-four elevators carry people and freight up and down the Willis Tower.

Fourteen double-deck units carry passengers nonstop to the 33rd-34th floor or the 66th-67th floor sky lobbies, which are transfer points for the single-deck elevators. These single-deck elevators travel a maximum of eight floors so that riders don't have to wait while an elevator stops at dozens of places.

The two Skydeck elevators are among the world's fastest elevators, traveling at a speed of 1,800 feet per minute. Your ears will pop as they adjust to the changing air pressure during your speedy trip. You also will be treated to an elevator presentation that tells you when you achieve the altitude of other world icons, such as the St. Louis Gateway Arch and the Eiffel Tower, on your way to Skydeck.

When you're riding an elevator, just about the last thing you're thinking about is the wind outside. At the Willis Tower, a wind of 60 miles per hour can make the top of the building sway a little; it was designed to sway about 6 inches. While you would not even notice that, the small amount of sway could jam an elevator. To accommodate the sway, the speed of the longest elevators is reduced.

Six freight elevators also serve the building. And 14 escalators help people reach the lower mezzanine levels and floors and the two-story sky lobbies.

KEEPING COOL AND STAYING WARM

Each day heat builds up inside the skin of the Willis Tower. Sunlight pours in the windows (despite their tinting); computers and other electrical equipment generate heat; and all those warm people help push the temperature up.

A sophisticated air-handling system cools, filters and circulates air throughout the building. The air comes in and out of each floor through ceiling vents.

Sometimes heat is needed on the shady side of the building. Or perimeter heating is needed all over on cold winter days. At the direction of the command center, air can be filtered and exchanged between the warm and cool areas of the building or electric boilers can supply heat throughout the offices on the perimeter.

On the main mechanical floor are enormous chillers. These large refrigerator units cool water to chill the air and pump it to major physical plant areas throughout the building, where it is then circulated to each floor. Four large cooling towers three stories high on the 106th-109th levels take water already used by the chillers and cool it down using fans as the water runs down the inside of each tower. The work of the chillers and cooling towers is monitored by the command center.

WASHING THE OUTSIDE

Six automatic window robots clean the outside of the building eight times a year.

This system, unique to the Willis Tower, uses machines on tracks on the outside of the building. Moving down in its track, each machine cleans about 45 feet a minute, first spraying the building with water and detergent, then brushing the windows and aluminum panels to remove the dirt, and finally vacuuming up the dirty water. The machine then cleans and filters the water to repeat the process on another stretch of wall.

The 5,000-pound wash robots are located in roundhouses on rails on the roof setbacks when they are not moving down the sides of the building. Two are at level 50, two at level 66, one at level 90 and one in the penthouse at level 110. Each has to clean a face of the building clear down to just above street level.

The all-glass enclosures that make up The Ledges on the 103rd floor were built to retract into the building so the cleaning robots can do their job. You can see the rails when you look back at the side of the building while standing on The Ledge.

Down on the ground, a special small-scale “street sweeper” machine is used to clean the plaza areas.

ENVIRONMENTAL EFFORTS AT THE WILLIS TOWER

REDUCING, REUSING AND RECYCLING

Who knew that the true color of the Willis Tower was green? The Willis Tower not only is an innovator in promoting green practices among its tenants, but also stands as a leader among tall buildings in increasing energy and water efficiency and reducing waste.

Over the past 20 years, the Tower has reduced annual electricity consumption by 34 percent by installing enhanced lighting systems and controls and adopting special conservation practices. The building saves 10 million gallons of water, or the equivalent of 156,448 bathtubs full, each year by relying on reduced water-flow fixtures. These successes are spurring the building to look into certification as a LEED (Leader in Energy and Environmental Design) building and explore renewable energy resources, such as solar and wind power. One day there might be “green roofs” covered with vegetation (the tallest green roof in the nation, anyone?) to conserve energy.

The shrinking carbon footprint

The Willis Tower has reduced its carbon emissions by 51 million pounds a year since 1987. That’s the equivalent of planting 4.4 million trees or taking 4.418 cars off the road each year.

The Tower began its recycling program in June 1993 by recycling 241 tons of paper. Today the building recycles 445 tons a year—enough to save more than 3,500 trees annually. Some 12 tons of office electronics, such as computers and printers, are recycled each year.

Being a green leader is not just about making the planet safe—it’s about caring for the people in the building. The Willis Tower implemented green cleaning programs to reduce the use of harsh chemicals. The building offers incentives for people to ride their bikes to work, such as providing shower and changing facilities and indoor bike parking. Tenants who drive hybrid vehicles may park at a reduced fee. If people have an off-site meeting or just want to take a spin up to Millennium Park, they can hop on loaner bikes provided by the building during biking season.

Ongoing education of all the people in the building has contributed to the success of the recycling and source reduction program at the Willis Tower. Each different kind of business in the Willis Tower tailors the program to meet its needs.

The maintenance crew collects trash and recyclables daily, emptying the trash into compactors on the lower level and sorting recyclables into special bins for carting away to be recycled.

HOW THE WILLIS TOWER REDUCES WASTE

- » Using reduced-flow faucets and water fixtures
- » Using long-life, energy-efficient light bulbs and electrical fixtures with timers and controls
- » Double-sided copying
- » Reusing laser printer and copier toner cartridges
- » Sending email rather than printed memos
- » Replacing disposable with reusable items (such as coffee mugs for foam cups)
- » Using renewable, refillable or returnable containers
- » Donating or recycling surplus office materials

WHAT'S RECYCLED AT THE WILLIS TOWER

- » Paper
- » Cardboard and chipboard
- » Aluminum
- » Plastic (#1 PET and #2 HDPE)
- » Glass
- » Aluminum and copper wiring
- » Electrical components from computers and other electronics
- » Batteries

WHAT'S THROWN AWAY AT THE WILLIS TOWER

- » Food products
- » Food containers, utensils and wrappers
- » Any waste paper contaminated by food or liquid

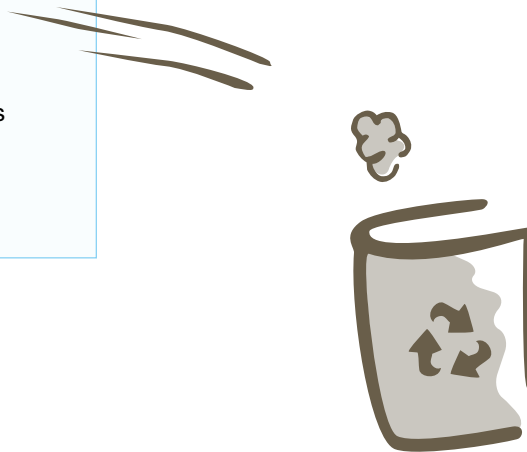
A NEW KIND OF HEAT EXCHANGE

The Willis Tower has a unique heat-salvage system that takes heat from the electrical transformers in the basement levels and uses it to heat water for the rest of the Tower. This “by-product” heat is enough to create hot water for the equivalent of 1,000 homes. This exchange saves energy.

OUR FINE FEATHERED HUNTERS

Finding a hunting perch at the Willis Tower are the peregrine falcons introduced to the city many years ago to control the pigeon population.

While the birds make their nests at lower levels on other nearby buildings, they rely on the Willis Tower to look for prey. They sit up at the 66th and 90th levels, which are set back from the rest of the building, to hunt. Upon spotting their prey, they will swoop down, catch it and bring it back up to the same spot to eat it. Sometimes the falcons will hover on the updrafts along the building, seemingly making no effort to stay afloat many stories above the street.



SWEET HOME CHICAGO.

—Robert Johnson, composer (and many blues singers, including the Blues Brothers, in the 1980 movie of the same name)

ACTIVITIES AND QUESTIONS FOR STUDENTS

A SKYSCRAPER AMONG SKYSCRAPERS

TRY THIS: SPOT THE WILLIS TOWER ON YOUR WAY INTO CHICAGO

Look for the Willis Tower as you drive closer to Chicago. How far away are you when you first spot the Tower? Ask the bus driver to clock the distance and have your students use roadway mile signs to estimate.

On a clear day, the airline safety strobe lights on top of the Tower can be seen from as far away as Milwaukee, Wisc., Joliet, Ill., and Michigan City, Ind. We've also been told that the antenna towers can be seen from Holland, Mich. The lights atop the antenna towers are focused on the horizon, so they are not as easy to see on the ground as they are from the air. The lights blink 40 times a minute, shining 200,000 candelas during the day and 1,000 candelas at night.

Try the same activity on your way home.

DESIGNING AND CONSTRUCTING THE WILLIS TOWER

ROLE-PLAY THIS: WHAT PROBLEMS MUST YOU SOLVE TO BUILD A TOWER THIS HIGH?

Ask your students to assume the role of architects and engineers given the assignment of creating the world's tallest building, which the Willis Tower was when it was built as the Sears Tower.

What would they have to consider? What questions would they ask the Sears, Roebuck Co.? What problems would they have to solve? What challenges might they face 10 years after construction?

You could role-play this question, with several students acting as the Sears executives and others playing the role of the architects and engineers. Students could use blocks, building bricks or the computer to "construct" their creations.



CALCULATE THIS: HOW MANY "YOUS" WOULD HAVE TO BE STACKED HEAD TO TOE TO EQUAL THE HEIGHT OF THE WILLIS TOWER?

The Willis Tower is 1,450 feet (442 meters) to the roof. How many of you could stand head to toe next to the Tower and touch the roof?

ART AND ARTISTRY AT THE WILLIS TOWER

DISCUSS THIS: WHAT DO THE SHAPES MEAN?

Take your students to look at "Universe." Let them study it a while before you ask any questions. Have them look away when they tell you what is most memorable about it. Does it make them feel anything in particular? What do the shapes mean to them? Why might Calder have chosen them? What does "universe" mean here? Why might he have chosen the colors he did? Why do they think the sculpture is here in the midst of a busy office building? What kind of music, if any, seems to fit this sculpture?

DESIGN THIS: MAKE YOUR OWN "UNIVERSE"

When you're back in the classroom, have your students make mobiles of their own, using the shapes Calder used or ones of their design. Required materials would be fishing line or thin string, a hole punch, scissors, construction paper and items to serve as supports for holding the dangling shapes (such as hangers, dowels, chop sticks or twigs). What would they call their masterpieces?

OUR CITY WITHIN A CITY

CONSIDER THIS: WHAT BUSINESSES WOULD YOU INCLUDE IN THE WILLIS TOWER?

Ask your students what businesses they would like to see at the Willis Tower. Check the businesses in the concourse and lower levels (just around either corner from the Skydeck lobby).

What's the "city within a city" missing, if anything? Where should your students' businesses be located? Who would their customers be? If you're not from Chicago, would those same businesses fit in your hometown? Why or why not?

Ask them to draw their business operations and describe them. At your school, you could create a bulletin board with their businesses located on the floors they choose. The computer game, Sim Tower, lets them choose businesses for their Tower (see page 33 for details).

THE WORLD FROM THE TOP

DARE THIS: WALK OUT ON THE LEDGE

Ask your students to describe in one word how they would feel being in a clear bubble high atop the city looking at the ground 1,353 feet below them. If you do this ahead of time, have them write it down. Once you're in the Skydeck, recruit volunteers to walk out on The Ledge and give a different one-word answer. What changed? Who can come up with the best word to describe the experience? You also can ask them to write paragraph or short poem about what they felt being out there.

PICTURE THIS: TRY COLLABORATIVE PHOTOGRAPHY TO CREATE A PANORAMIC VIEW

Have your students take digital photos of the scenery, either using a regular digital camera or a cell phone camera, overlapping the photos to create a customized wide view of the city. Each student could be responsible for a portion. When you get back to school, you can overlap them using photo software or by printing them out and taping them over each other on the wall. Email the finished product to us, and it may be selected as the Photo of the Day for display on our Skydeck monitors.

DISCUSS THIS: WHAT WOULD IT BE LIKE TO "FLY BLIND?"

Head up to the Skydeck when visibility is low to give students an idea of what it must be like to be pilots who "fly blind" with only instruments to guide them. How would they feel doing this? What are the clues that your students can find to orient themselves? How could compasses help? What other information would they need to fly safely?

TRY THIS: CREATE YOUR OWN SOUVENIR

Create your own souvenir of the Willis Tower by doing a “rubbing” of the steel medallions in the first floor lobbies. The medallions are inlaid in the granite floors.

Can your students tell what the design represents? Use a crayon or the side of a soft pencil on paper placed over the design. Rub lightly and you will have the design to take home with you.

HOW IT ALL WORKS: SAFETY, SYSTEMS AND MAINTENANCE

FIGURE THIS: HOW LONG IS YOUR ELEVATOR RIDE?

The Willis Skydeck elevators travel 1,800 feet per minute. You get on the elevator on the second lower level, which is 28 feet below the ground floor from which the height of the building is measured. The observation deck is 1,353 feet high. How many feet did you travel? And how long was your elevator ride? Time your trips. Were the times what you predicted?

ENVIRONMENTAL EFFORTS AT THE WILLIS TOWER

TRY THIS: HELP THE ENVIRONMENT AT YOUR SCHOOL

If you don’t already have a program to recycle and help cut down on waste in your school, your students can start one. Call your local town or city government and ask what programs are already in place in your community. See how your school can fit in.

Start with a brainstorm among your students. Ask them to name something they can do that corresponds to each letter of the alphabet (A is for recycling aluminum cans, B is for avoiding bottled water in favor of drinking tap water....). Make “reduce, reuse, recycle” the first thing they see in the morning—and keep it top of mind during the day. Your students can urge their friends to bring their lunch to school in reusable containers. Your art projects could involve scrap materials used in new ways. You can even have the class calculate and trade representative carbon credits for walking, riding a bike, taking a bus or driving to school. This list is endless.

A source of helpful information in the Chicago area is Keep Chicago Beautiful, Inc. (KCB), which offers seminars for teachers on solid waste management and recycling and programs for children and community groups. For information, call (312) 984-0448 or visit the Web site: <http://www.kcb.org>.

YOU AND THE VIEW

FIND THIS OUTSIDE: LANDMARKS TO LOCATE BY DAY

Check off each landmark as you find it and circle the direction in which you were looking (N =North, E = East, S= South and W = West).

- Two parks named after presidents

N E S W

N E S W

- Another work of art by Alexander Calder

N E S W

- Two train stations

N E S W

N E S W

- A theater that's a curly ribbon of metal in Millennium Park

N E S W

- A high-altitude statue of the "Goddess of Grain"

N E S W

- Four sports arenas

N E S W

N E S W

N E S W

N E S W

- A newcomer to the skyline named after Donald Trump

N E S W

- Four museums

N E S W

N E S W

N E S W

N E S W

- A lighthouse near Navy Pier

N E S W

- Two churches

N E S W

N E S W

- Concert venue where an airport once stood

N E S W

- Twin circular buildings

N E S W

- Two buildings with unusual shapes on top (circle, diamond, triangle, etc.)

N E S W

N E S W

- Inmates playing ball or exercising on a prison rooftop

N E S W

- Your favorite building from on high

N E S W

YOU AND THE VIEW

FIND THIS OUTSIDE: LANDMARKS TO LOCATE BY NIGHT

Check off each landmark as you find it and circle the direction in which you were looking (N =North, E = East, S= South and W = West).

- | | |
|---|---|
| <input type="checkbox"/> The baseball fields of University of Illinois at Chicago
N E S W | <input type="checkbox"/> Merchandise Mart
N E S W |
| <input type="checkbox"/> A red buoy light
N E S W | <input type="checkbox"/> United Center
N E S W |
| <input type="checkbox"/> The John Hancock Center
N E S W | <input type="checkbox"/> McCormick Place
N E S W |
| <input type="checkbox"/> The Water Tower, which survived the Chicago fire (Hint: it's not labeled on your map but you can see it near the Hancock Center!)
N E S W | <input type="checkbox"/> A building with lighted castle-like "turrets"
N E S W |
| <input type="checkbox"/> The traffic cloverleaf ("spaghetti bowl") that connects Chicago's Dan Ryan and Kennedy expressways
N E S W | <input type="checkbox"/> The building that looks like New York City's Chrysler Building (Two Prudential Plaza)
N E S W |

I SPY ON HIGH

(For younger children.)

FIND THESE FAMOUS LANDMARKS.

- Soldier Field, where the Chicago Bears play
- Millennium Park, with a curly metal theater
- The Water Tower, which survived the Great Chicago Fire
- The United Center, where the Chicago Bulls play
- The Field Museum, where Sue the dinosaur rules
- The Chicago River, with boats floating up and down
- Midway Airport, with planes flying in and out
- The Hancock Building, with its famous X-marks on the sides
- U.S. Cellular Field, where the Chicago White Sox play

INDOOR SCAVENGER HUNT: LOOK, LISTEN AND INTERACT!

Enjoy the museum of Chicago today in the Skydeck entry area. Can you answer these questions in your indoor scavenger hunt??

- 1. Who signed the football on the wall?

- 2. How many photos do you see of basketball great Michael Jordan? ____
Bonus: What's his jersey number? ____
- 3. Find at least two Tyrannosaurus Rex dinosaurs (Hint: There are three)
- 4. Who said, "Less is more?"

- 5. How many films have have been made in Chicago? ____
- 6. Find Cloudgate, the shiny "bean" sculpture in Millennium Park.
(Hint: There are two images)
- 7. How long are the artificial vines that the Lincoln Park Zoo's great apes enjoy?
____ feet
- 8. Find an overhead shot of a ship on a beach.
- 9. How many meters high is the Jin Mao Tower? ____ meters
- 10. Find the world's biggest 103!
Then climb on it.
- 11. How many languages are spoken in the Skydeck on an average day? ____
- 12. Find something delicious to eat that's topped with goey cheese.

“COME RAIN OR COME SHINE” FIELD TRIP PLANS

Here are three great trips for you and your students. Even if visibility at the Skydeck is down to zero, there’s still plenty to do at the Nation’s Tallest School.

START EVERY TRIP THIS WAY

Focus your students on the trip by allowing them to choose (as individuals, pairs or teams) the names of Chicago landmarks. Depending on the grade and capabilities of your class, ask them to do research on the history and stats of the buildings and what the buildings are used for today. Perhaps they can build “their” buildings out of paper, cardboard, sugar cubes or found objects from nature, such as seeds, stones, twigs, etc. Get inspiration for re-creating Chicago in found natural objects by looking at photos of the Chicago Botanic Garden’s Wonderland Express that operates during the holiday season: <http://www.chicagobotanic.org/wonderland/about.php>.

They’ll be more engaged in your trip if they have a building they “own” as you all look out on the city from the Skydeck. They can photograph “their” building from there. Once you’re back in school after your trip, they can present their buildings to each other and you can re-create the city with everyone’s photos.

SUNNY DAY TRIP

Supplies you will need: paper, crayons or pencils, and enough copies of the “Find This Outside: Landmarks to Locate by Day” for each student or team of students (print this before you leave).

Prepare your students before your trip with a discussion about how to determine the tallest buildings in the world. Should a building be judged by the number of occupied floors? The height of the “architectural top,” including spires but not communication antennas? The height to the top of

the highest roof? Or the height from the sidewalk to the highest tip (either a spire or an antenna)? These questions have been debated by the Council on Tall Buildings and Urban Habitat: <http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/tabid/446/language/en-US/Default.aspx>. What do your students think?

You also can do role-playing about the design and construction of the Willis Tower. Your students might use wooden blocks or plastic building bricks (or the computer) to create their own designs.

ON THE DAY OF YOUR TRIP, YOU CAN:

- » Find the Willis Tower antennas on your way into town.
- » Use the map to locate the appropriate parking spot and come in the Skydeck entrance off of Jackson Boulevard.
- » Be sure to check out the model of the Willis Tower in the lobby by LEGO® Architecture artist Adam Reed Tucker. He led teams of Skydeck visitors in building the 20-foot replica out of 50,000 LEGO® bricks over two days in September 2008.
- » Go down to lower level 2 to engage with our rich interactive exhibits on Chicago’s sports, arts, music, pop culture, architecture, world-class attractions and people.
- » Enjoy the nine-minute presentation of “Reaching for the Skies” in the theater.
- » Go up our high-speed elevators to the Skydeck, passing the heights of the world’s tallest structures along the way in a brand-new educational presentation.
- » Enjoy the tremendous view.
- » Take turns stepping out on The Ledge (noting what you see all around you and how you feel!)
- » Create your class’s custom panoramic photo.

MAKE BIG PLANS. AIM HIGH IN HOPE AND WORK.

—Daniel Burnham, architect and planner of Chicago

- » Find the landmarks on the list or play “I Spy on High.”
- » Go down the elevators (timing how fast the ride is, if you want).
- » Go out of the Skydeck pavilion and turn right to go around to the front entrance of the Willis Tower.
- » Enter and note the construction of the building and see and talk about Calder’s “Universe.”
- » Head back to your school and have your students write back to us about their visit. Email us your photos for possible display as Photo of the Day on Skydeck monitors.

CLEAR EVENING TRIP

Supplies you will need: paper, crayons or pencils, and enough copies of the “Find This Outside: Landmarks to Locate by Night” for each student or team of students (print this before you leave).

As you would for a daytime trip, prepare your students before your trip with a discussion about how to determine the tallest buildings in the world. Should a building be judged by the number of occupied floors? The height of the “architectural top,” including spires but not communication antennas? The height to the top of the highest roof? Or the height from the sidewalk to the highest tip (either a spire or an antenna)? These questions have been debated by the Council on Tall Buildings and Urban Habitat: <http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/tabid/446/language/en-US/Default.aspx>. What do your students think?

You also can do role-playing about the design and construction of the Willis Tower. Your students might use wooden blocks or plastic building bricks (or the computer) to create their own designs.

ON THE DAY OF YOUR TRIP, YOU CAN:

- » Find the Willis Tower on your way into town.
- » Use the map to locate the appropriate parking spot and come in the Skydeck entrance off of Jackson Boulevard.
- » Be sure to check out the model of the Willis Tower in the lobby by LEGO® Architecture artist Adam Reed Tucker. He led teams of Skydeck visitors in building the 20-foot replica out of 50,000 LEGO® bricks over two days in September 2008.
- » Go down to lower level 2 to engage with our rich interactive exhibits on Chicago’s sports, arts, music, pop culture, architecture, world-class attractions and people.
- » Enjoy the nine-minute presentation of “Reaching for the Skies” in the theater.
- » Go up our high-speed elevators to the Skydeck, passing the heights of the world’s tallest structures along the way in a brand-new educational presentation.
- » Enjoy the tremendous night-time view.
- » Take turns stepping out on The Ledge (noting what you see all around you and how you feel!)
- » Create your class’s custom panoramic photo.
- » Find the landmarks on the list or play “I Spy on High.”
- » Go down the elevators (timing how fast the ride is, if you want).
- » Go out of the Skydeck pavilion and turn right to go around to the front entrance of the Willis Tower.
- » Enter and note the construction of the building and see and talk about Calder’s “Universe.”
- » Head back to your school and have your students write back to us about their visit. Email us your photos for possible display as Photo of the Day on Skydeck monitors.

RAINY DAY/RAINY EVENING TRIP

Supplies you will need: paper, crayons or pencils, and enough copies of the “Indoor Scavenger Hunt: Look, Listen And Interact!” for each student or team of students (print this before you leave).

Prepare your students before your trip with a discussion about how to determine the tallest buildings in the world. Should a building be judged by the number of occupied floors? The height of the “architectural top,” including spires but not communication antennas? The height to the top of the highest roof? Or the height from the sidewalk to the highest tip (either a spire or an antenna)? These questions have been debated by the Council on Tall Buildings and Urban Habitat: <http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/tabid/446/language/en-US/Default.aspx>. What do your students think?

You also can do role-playing about the design and construction of the Willis Tower. Your students might use wooden blocks or plastic building bricks (or the computer) to create their own designs.

ON THE DAY OF YOUR TRIP, YOU CAN:

- » Find the Willis Tower on your way into town. It may be shrouded in clouds!
- » Use the map to locate the appropriate parking spot and come in the Skydeck entrance off of Jackson Boulevard.
- » Be sure to check out the model of the Willis Tower in the lobby by LEGO® Architecture artist Adam Reed Tucker. He led teams of Skydeck visitors in building the 20-foot replica out of 50,000 LEGO® bricks over two days in September 2008.
- » Go down to lower level 2 to engage with our rich interactive exhibits on Chicago’s sports, arts, music, pop culture, architecture, world-class attractions and people.
- » Start the “Indoor Scavenger Hunt: Look, Listen And Interact!”
- » Enjoy the nine-minute presentation of “Reaching for the Skies” in the theater.
- » Go up our high-speed elevators to the Skydeck, passing the heights of the world’s tallest structures along the way in a brand-new educational presentation.
- » See if Mother Nature will let you see the tops of the Trump Tower, John Hancock Center and any others breaking through the clouds.
- » Talk about what it would be like to be an airplane pilot in zero visibility.
- » Take turns stepping out on The Ledge (and seeing how you feel!). You might even try a “superhero moment” by lying face down on the floor of The Ledge. It’s as if you are flying through the sky!
- » Go down the elevators (timing how fast the ride is, if you want).
- » Go out the Skydeck pavilion and turn right to go around to the front entrance of the Willis Tower.
- » Enter and note the construction of the building and see and talk about Calder’s “Universe.”
- » Talk about the businesses in the Tower and what your students would add.
- » Head back to your school and have your students write back to us about their visit. [Email](#) us any photos for possible display as Photo of the Day on Skydeck monitors.

FOR MORE INFORMATION: AN ANNOTATED BIBLIOGRAPHY

The following resources are available through public libraries or online. Some also may be purchased through Skydeck stores. Please call for availability: 1-(312) 993-3716.

BOOKS

Adams, Robert. *Buildings: How They Work*. New York: Sterling Publishing Co., Inc., 1995. Offers an overview of building through the ages and the technology that has changed where people live and work.

Bennett, David. *Skyscrapers, Form & Function*. New York: Simon & Schuster, 1995. A glossy, beautifully photographed, oversized book geared to adults and older students. Includes a 24-hour diary of life at the Sears Tower and large foldout of the building. Covers the development of skyscrapers over the years. Includes an excellent bibliography of sources for advanced students.

Curlee, Lynn. *Skyscraper*. New York: Atheneum Books for Young Readers, Simon & Shuster, 2007. Gorgeous illustrations propel the older student along. It closes with illustrations of the "Tribute of Light" marking the Twin Towers of the World Trade Center and the Freedom Tower that will stand in their place. "To build well is an act of peace," architect Kevin Roche is quoted as saying at the book's conclusion.

Doherty, Craig A., and Doherty, Katherine M. *The Sears Tower*. Woodbridge, CT: Blackbirch Press, Inc., 1995. Children's book on the history of the Sears Tower and how it was designed and built. Includes glossary, chronology, and suggestions for further reading and full library source notes.

Gibbons, Gail. *Up Goes the Skyscraper!* New York: Macmillan Publishing Co., 1986. A very simple and clear illustrated children's book about the building of a skyscraper. Key words are in boldface. Older children might like it for its clarity about the building process.

Giblin, James Cross. *The Skyscraper Book*. New York: Thomas Y. Crowell Junior Books, 1981. Book for older elementary and middle-school students on the development of skyscrapers. Offers interesting anecdotes about what inspired early developers. Includes "Fabulous Facts" about skyscrapers and architectural terms. Excellent bibliography.

Goldberg, Paul. *The Skyscraper*. New York: Alfred Knopf, 1981. An adult-reading-level book that comments on the "greatest of American building forms, the skyscraper." Compares New York and Chicago rivalry in designs and forms of skyscrapers. Abundant in photos and illustrations.

Huxtable, Ada Louise. *The Tall Building Artistically Reconsidered: The Search for a Skyscraper Style*. New York: Pantheon Books, 1982. A discussion of skyscrapers as products of art, business, and politics in the past and the future. For adults or sophisticated students.

Ingoglia, Gina. *The Big Book of Real Skyscrapers*. New York: Grosset & Dunlap, 1989. Illustrated children's book on the history, structure and building of skyscrapers. Includes an excellent glossary.

Macaulay, David. *Unbuilding*. Boston: Houghton Mifflin Co., 1980. A fantasy dismantling of the Empire State Building, revealing how it is made. With wonderful detailed illustrations.

Macaulay, David. *Building Big*. Boston: Houghton Mifflin Co., 2000. Companion to the video originally shown on PBS. Illustrated in fine detail for all ages, showing skyscrapers as a building marvel.

Masengarb, Jennifer, and Kinsner, Jean. *Schoolyards to Skylines: Teaching with Chicago's Amazing Architecture*. Chicago: Chicago Architecture Foundation: 2002. This 500-page loose-leaf-bound resource books offers a K-8 curriculum aligned to Illinois State Goals and Chicago Academic Standards and adaptable nationwide. Uses architecture as a way to teach social sciences, science, mathematics, language arts, and fine arts.

Nash, Paul. *Super Structures*. Ada, OK: Garrett Educational Corporation, 1989. A children's book that considers the Sears Tower among other tall or large world structures, such as the Great Temple of Abu Simbel, the Sydney Opera House and the Great Buddha of Nara. Photographs with short descriptions.

Peet, Creighton. *The First Book of Skyscrapers*. New York: Franklin Watts, Inc., 1964. Children's book with photos. Dated, but offers a thorough look at the basics of building a huge structure.

Pridmore, Jay. *Sears Tower, A Building Book from the Chicago Architectural Foundation*. Rohnert Park, CA: Pomegranate Communications, Inc., 2002. Devotes its 64 pages to our favorite building, calling it "the spiritual center of twentieth-century American architecture." Perfect for older students interested in the art and science of the building.

Pridmore, Jay, and Larson, George A. *Chicago Architecture and Design*. New York: Harry N. Abrams, Inc., 2005. Provides an overview of Chicago architecture for teachers and other adults. Beautiful photos.

Roza, Greg. *A Kid's Guide to Incredible Technology, The Incredible Story of Skyscrapers*. New York: PowerKids Press, 2004. Offers good basic information with lots of facts and figures and a glossary. Directs the reader to up-to-date links online.

Severance, John B. *Skyscrapers: How America Grew Up*. New York: Holiday House, 2000. Starts by noting the Great Pyramid of Cheops in Egypt could have been the first skyscraper with its height of 50 stories. Provides great storytelling about innovation in building for middle-graders.

Terranova, Antonino. *Skyscrapers*. Vercelli, Italy: Barnes & Noble Books with arrangement with White Star, 2003. Oversized, emphasizing stunning architectural photography. Provides a world tour for older students and adults.

The Learning Channel. *Super Structures of the World: Skyscrapers*. Farmington Hills, MI. Asks if Frank Lloyd Wright's idea of building a mile-high building today might not be the "futuristic folly" it was in his time. Color photos. Includes a chapter on the World Trade Center and the attacks on Sept. 11, 2001.

Wilson, Forrest. *Architecture: A Book of Projects for Young Adults*. New York: Van Nostrand Reinhold Co., 1968. Offers 33 projects for older students to build to test ways of designing and building structures. Illustrated.

Yunker, Richard. *On Site: The Construction of a High-Rise*. New York: Thomas Y. Crowell, 1980. Covers construction of tall buildings at six different Chicago sites. Photographs show roles of workers and sequence of events. Lots of detail about how teamwork produces a building.

VIDEOS ON DVD/VHS

Building Big with David Macaulay: Skyscrapers. Boston: WGBH Science Unit and Production Group, Inc., 2000. (DVD/VHS.) An engaging tour of world's tallest buildings, from Gothic cathedrals to the Eiffel Tower to the Empire State Building to Petronas Towers and more. David Macaulay, the author of *The Way Things Work*, gives this video its sparkle. Suitable for later elementary grades. Comes with an activity guide for making a paper skyscraper with two sheets of newspaper. Check out the companion book mentioned in this guide as well as this Web site with activities: <http://www.pbs.org/wgbh/buildingbig/skyscraper/>.

How Do They Build Skyscrapers? Popular Mechanics for Kids, Hearst Corp. Troy, MI: Anchor Bay Entertainment, 1996. (VHS only.) A good overview of building a "baby skyscraper" of 20 stories. Features "Pop," a workman character in all of the Popular Mechanics videos talking with a preadolescent boy. Good for elementary to middle-school students. Your students' favorite sequences will be the buildings being blown up at the end.

Skyscraper. The History Channel. New York: A&E Television Networks, 2006. (DVD.) Explores the use of the following tools used to create skyscrapers: the foundation drill rig, the tower crane, the impact wrench, the power trowel and the total station. Looks at construction of Chicago's Trump International Hotel and Tower, among others.

Modern Marvels: The Sears Tower. The History Channel. New York: A&E Television Networks, 2007. (DVD.) Explores the history of the building from its conception in the late 1960s through its construction and the various changes it has seen throughout the years. Offers facts and interviews with original architects and engineers as well as current staff.

ONLINE RESOURCES

Skydeck Chicago

<http://www.theskydeck.com/>

Be sure to check out our pages on [Facebook.com](http://www.facebook.com) and [MySpace.com](http://www.myspace.com). And you can follow us on Twitter by going to twitter.com.

Willis Tower/Sears Tower

http://www.som.com/content.cfm/sears_tower
This page on the Web site of Skidmore, Owings & Merrill, LLP, the architecture firm that designed the Sears Tower, offers key facts, awards received and a small image gallery.

<http://www.flickr.com/photos/tags/skydeck/>
<http://www.flickr.com/photos/tags/willistower/>
<http://www.flickr.com/photos/tags/searstower/>
Searching flickr, a free, public photo sharing service, for images tagged with "skydeck," "willistower" or "searstower" yields thousands of photos uploaded by different users. This is a great way to view the building from many different perspectives, locations and times of day.

http://en.wikipedia.org/wiki/Willis_Tower
Offers a wealth of up-to-date information including facts, history, future plans and other tidbits on the Willis Tower.

<http://us.factory.lego.com/gallery/buildinginstructions/Sears%20Tower.aspx>
Provides step-by-step instructions on how to construct the Willis Tower using LEGO® bricks. (Note: LEGO® also makes a Sears Tower model kit as part of its Architecture series. It was designed by LEGO® Architecture artist Adam Reed Tucker who also built the 20-foot replica in the Willis Tower lobby. You can purchase it in the Skydeck stores or by visiting the Skydeck merchandise section of the Skydeck Web site at <http://www.theskydeck.com>.)

<http://www.searstower.org/articles.html>
Features news clippings from throughout the building's history.

Chicago Architecture

<http://www.architecture.org/>
<http://www.architecture.org/schoolyards.html>
The Chicago Architecture Foundation's Web site offers information on architectural tours around the city, lectures, exhibitions, symposiums and other programs and events. Provides dozens of links to other architecture-related sites. View sample lessons from its *Schoolyards to Skylines* teacher resource guide (covered above in the book section).

<http://www.chicagoarchitecture.info>
Provides information and photographs of roughly 1,000 buildings around Chicago. Each building's page offers a place where visitors can leave comments and rate the buildings. The site also features an interactive map populated with the location of each building in the database.

<http://www.wttw.com/main.taf?p=1,53>
WTTW's televised documentary tour of our city's magnificent lakefront is called "Chicago's Lakefront." Watch the videos by Geoffrey Baer online.

<http://www.ci.chi.il.us/Landmarks/Tours/Tours.html>
Features virtual tours of many Chicago historic landmarks including tall buildings, residential structures, parks, etc. Also offers historic image galleries of the buildings cited.

<http://www.chicagoarchitecturetoday.com/buildingdirectory.htm>
Offers a pictorial directory of Chicago's buildings, links to articles about architecture around the city, an extensive glossary of architecture terms and more.

<http://encyclopedia.chicagohistory.org/>
Encyclopedia of Chicago, supported by the Chicago History Museum, the Newberry Library and Northwestern University, offers historical photos of Chicago and its architecture.

http://en.wikipedia.org/wiki/Architecture_of_Chicago
Provides a brief history of architecture around Chicago as well as a timeline and links to notable buildings

Tall Buildings

<http://skyscraperpage.com/>
Features information and detailed diagrams and illustrations comparing skyscrapers and their respective cities.

<http://www.skyscrapernews.com/>
Regularly publishes news stories on tall buildings around the world.

<http://www.moma.org/interactives/exhibitions/2004/tallbuildings/>
Though a few years old, this microsite presents relevant information on design issues that architects and engineers must take into account when designing super-tall structures.

<http://www.ctbuh.org/>
The Council on Tall Buildings and Urban Habitat maintains databases of the world's tallest buildings, including images, presentations, videos and audio. This group sets the criteria for defining and measuring tall structures.

http://en.wikipedia.org/wiki/List_of_tallest_buildings_and_structures_in_the_world
Provides lists of the world's tallest structures.

<http://www.emporis.com/en/>
Provides an extensive searchable database of buildings around the world.

<http://www.GreatBuildings.com/gbc.html>
Provides a searchable database of buildings.

SOFTWARE

LEGO® provides a free software program called LEGO® Digital Designer that allows you to build 3D models using virtual LEGO® bricks. It is a simple program and is easy to use. After a model is built, you can order the bricks directly from LEGO® as a kit to build in real life. You can also share your model online with other users. Find more information and a link to download here:
<http://idd.lego.com/>

Have your students try *SimTower*. This computer game, first created by Maxis in 1995 and now available free online (just do an online search for it) allows your students to create mixed-use tall buildings, solving many of the problems that real designers and building managers do. The program prompts designers to add features, such as a recycling program and restaurants. They also might try the somewhat more challenging *Yoot Tower* published by Sega in 1999. Students can choose and name their businesses. Again, search for a free download online.

MORE ABOUT YOUR TRIP

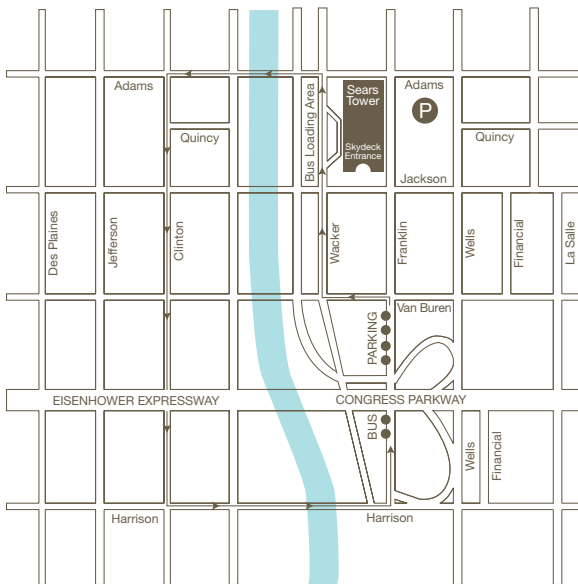
GETTING HERE

It's easy to find us at 233 South Wacker Drive in Chicago. Just visit the directions page of our Web site: <http://www.theskydeck.com/directions.asp>.

LOCAL MAP/BUS AND AUTOMOBILE PARKING

Buses may unload and load on South Wacker Drive in front of the building, with main bus parking on Franklin Street between Van Buren Street and Congress Parkway, with additional spots between Congress and Harrison.

Self-parking for the Skydeck is at Tower Self Park, 211 West Adams Street. Please enter on Adams, Franklin or Wells. For more information, call (312) 782-5570.



ENTERING THE SKYDECK

You will enter the Skydeck pavilion off of Jackson Boulevard between South Wacker Drive and Franklin Street, where you will be directed to an elevator down to the start of your Skydeck adventure.

ACCESSIBILITY

The Willis Tower and Skydeck Chicago are fully accessible. Please use automated doors next to the revolving doors at the Skydeck entrance on Jackson Boulevard.

MEALS AND SNACKS

Your group may arrange for meals on weekdays or for seating for brown bag lunches or snacks by calling (312) 875-9447. We have a new lunchroom with plenty of tables and seating.

Food is not permitted in the Skydeck areas.

NUMBERS TO KNOW

For school group reservations, call group sales during regular business hours at 1-877-SKY-DECK (759-3325) or (312) 875-9447 or email sales@theskydeck.com. Special rates are available for groups of 20 or more. You will need to present your tax-exemption certificate.

HOURS

The Skydeck is open seven days a week, 365 days a year.

From October through March, the Skydeck is open from 10 a.m. until 8 p.m., with the last ticket being sold at 7:30 p.m. From April through September, the Skydeck is open from 9 a.m. until 10 p.m., with the last ticket being sold at 9:30 p.m.

U.S. Equities Realty

U.S. Equities Asset Management LLC is a leading full-service commercial real estate firm headquartered in Chicago. The company serves as strategic real estate advisors to clients throughout the United States and in South America. Founded in 1978, U.S. Equities is recognized for its highly skilled professional staff, broad-based capabilities and commitment to customer service.



FOR SCHOOL GROUP RESERVATIONS OR MORE INFORMATION,
call 1-877-SKY-DECK (759-3325) toll free or (312) 875-9447.
You also may email sales@theskydeck.com.



Skydeck Chicago
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