

TOWERS OF TOMORROW

WITH
**LEGO®
BRICKS**



EDUCATOR'S GUIDE



INDIANA STATE
MUSEUM
AND HISTORIC SITES

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FLYING FISH



Museums of History NSW

Towers of Tomorrow with LEGO® Bricks is a traveling exhibition from Museums of History NSW and toured internationally by Flying Fish.

Direct and indirect connections to the BC curriculum are listed below:

CORE COMPETENCIES

Creative Thinking

Critical and Reflective Thinking

ADST

Ideating

Prototyping

Testing

Making

Sharing

Applied Skills

ADST K–3:
Designs grow out of natural curiosity, skills can be developed through play

ADST 4–5:
Designs can be improved with prototyping and testing, skills are developed through practice, effort, and action

Drafting 11

Drafting 12

Engineering 12

ARTS EDUCATION

Arts 3–7:
A variety of works of art from diverse places, Elements of Design

Studio Arts 3D 10–11:
Principles of design, variety of contexts, innovative and inter-cultural artists

MATH

Math 2

Math 3:
Construction of 3D objects

Math 8

Math 9

Workplace Math 10:
Proportional reasoning, 3D objects

ABOUT THE EXHIBITION



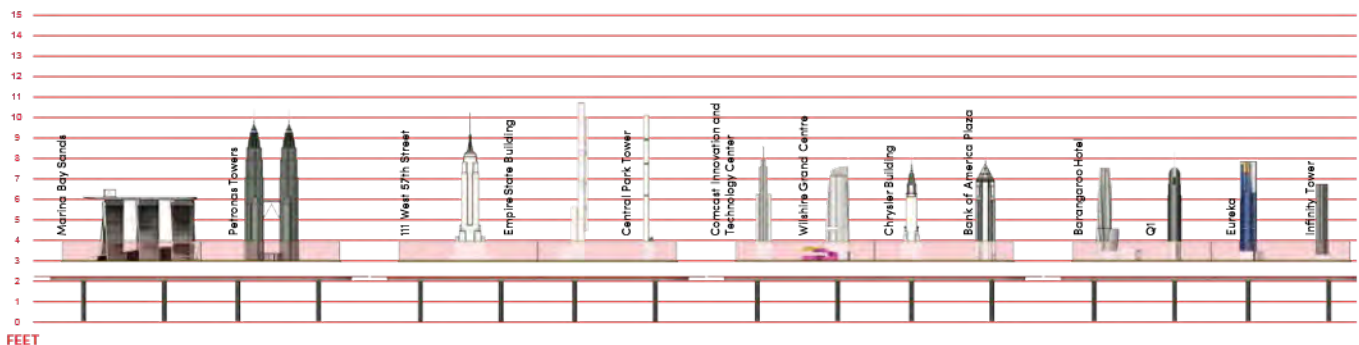
Towers of Tomorrow with LEGO® Bricks features 20 of the world’s most astonishing skyscrapers from the United States of America, Australia, Asia, Canada and United Arab Emirates constructed with breathtaking architectural detail and accuracy by Australia’s Ryan McNaught, the only certified LEGO® professional in the Southern Hemisphere.

The exhibition includes some of the most iconic and eye-popping towers from across North America including Toronto’s CN Tower, Philadelphia’s Comcast Technology Center, Los Angeles’ Wilshire Grand Center, Chicago’s Willis Tower, Atlanta’s Bank of America Plaza, New York’s super slender skyscrapers 111 West 57th Street, Central Park Towers and the city’s famous landmarks, Empire State Building and Chrysler Building.

Skyscrapers across Asia featured in the exhibition include Taiwan’s Taipei 101, Japan’s Tokyo Skytree, Kuala Lumpur’s twin Petronas Towers, Singapore’s extra-ordinary Marina Bay Sands and the amazing, self-contained city that is China’s Shanghai Tower. Australia is represented by Barangaroo Crown Hotel Resort in Sydney, the Eureka Tower in Melbourne, Infinity Tower in Brisbane and the Gold Coast’s Q1 building.

On a scale of 1:200 and built with stunning precision and attention to detail, the LEGO® towers offer visitors a birds-eye view of these extra-ordinary buildings and are just as impressive in model size. Visitors, young and old, can create their own ‘tower of tomorrow’ from over 200,000 loose LEGO® bricks in hands-on construction areas and add their creations to a steadily rising futuristic LEGO® metropolis inside the exhibition. Try a collaborative challenge and see if you can complete the 7’ high catenary arch.

Additional interactive areas will prompt visitors to consider an important question for the 21st century: What integral components are required to create thriving communities? Consider transportation, physical features, green spaces and more as you iterate a thriving, sustainable community.



INTERESTING FACTS



How many LEGO® bricks are used in this exhibition?

More than 577,000

How many hours did it take to build Towers of Tomorrow with LEGO® Bricks?

More than 2,400—nearly six months
of constant construction

How much do the towers weigh?

All the LEGO® in this exhibition
weighs more than 1.5 tons

What is the rarest LEGO® colour?

Gold

What is the most common LEGO® colour?

Trans-blue

What is the most common brick?

The 2x4

Which tower has the most LEGO® bricks?

Shanghai Tower (104,800 bricks)

Did you know?

More than 400 billion bricks have been
made since LEGO® was first invented

How old is LEGO®?

Invented in 1958, the LEGO® brick
is more than 55 years old

LEGO® Land—If LEGO® mini-figures
were people, they'd make up the largest
population in the world. Four billion have
been made in the last 30 years.

Sky high—40 billion LEGO® bricks stacked
one by one would reach from the earth
to the moon

Did you know?

The first LEGO® toys were made from wood
instead of plastic

Brain cruncher—915,103,765 combinations
can be created from just six 2x4 LEGO® bricks

TOWER DESCRIPTIONS



111 West 57th Street

New York City, USA

1,438 feet (438 meters) high

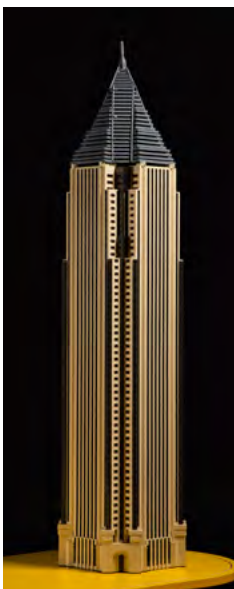
To be completed 2018

Designed by SHoP Architects

This staggeringly slim structure appears to defy gravity. Set on a tiny street frontage of just over 60 feet (18 meters), 111 West 57th Street has an astounding width-to-height ratio of 1:23. With unparalleled views of the city and Central Park, this residential tower is one of the new generation of super-slim skyscrapers that are changing New York City's skyline.

"This tower's narrow shape and intricate detailing presented challenges. Its gold patterning was too small to be reproduced with LEGO® bricks; instead we've added tan lines down the windows. We call this selective compression—selecting details to capture the essence of the building."

—Ryan McNaught, LEGO® certified professional



Bank of America Plaza

Atlanta, USA

1,023 feet (312 meters) high

Completed 1992

Designed by Kevin Roche, John Dinkeloo & Associates

Said to resemble a sharpened pencil, the Bank of America Plaza's postmodern design harks back to the golden age of Art Deco skyscrapers. Crowned with a pyramid covered with 23-carat gold, this soaring rose granite tower is a distinctive sight on the Atlanta skyline.

"While it looks simple enough, this tower was unexpectedly complicated to re-create. Despite being square, it has many difficult angles and facets. It is the shortest North American tower on display, but took longer to make than many of the others."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Barangaroo Hotel Resort

Sydney, Australia

890 feet (272 meters) high

To be completed 2021

Design by Wilkinson Eyre Architects

Like two glorious sails yet to unfurl, this ethereal tower will be a new landmark on the shoreline of Barangaroo. Built on a former maritime industrial site on Sydney Harbour, the proposed six-star international hotel resort will have expansive views, taking in the Sydney Opera House and the Sydney Harbour Bridge.

“Here’s another crazily unique shape. It’s tall and bulges in the middle, and is divided into wings that look like pointed petals from above. Once again, our ability to sculpt gentle curves and create colors was pushed to the limit.”

—Ryan McNaught, LEGO® certified professional



Burj Khalifa

Dubai, UAE

2,717 feet (828 meters) high

Completed 2010

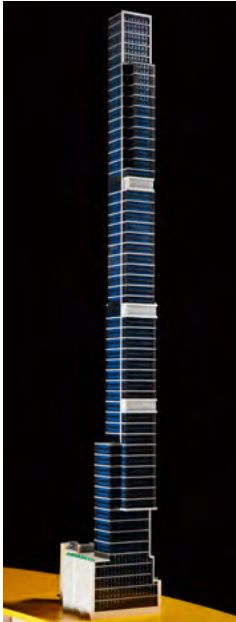
Designed by Skidmore, Owings & Merrill LLP

The Burj Khalifa is the world’s tallest tower, rising almost 650 feet (200 meters) above any other structure. Construction took 22 million hours of labour, and would have taken one person 7,534 years to complete. The tower’s three-lobed configuration is inspired by spider lily petals and its tapering form by minarets, a common feature in traditional Islamic architecture.

“The model was too tall to fit in our workshop, so we built it in five tiers, and could only assemble it in the car park.”

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Central Park Tower

Nordstrom Tower, 217 West 57th Street

New York City, USA

1,550 feet (472 meters) high

To be completed 2019

Designed by Adrian Smith + Gordon Gill Architecture

Central Park Tower is one of the many new super-tall towers on what is becoming known as New York's "Billionaires' Row." Valuable extra floor space was created by purchasing air rights above a neighboring building. When completed, the tower will be the western hemisphere's tallest residential building—unless another development gets there first.

"With its cantilever jutting out on one side, it's like nothing else around it. You either love it or you hate it—I think it's a cool building."

—Ryan McNaught, LEGO® certified professional



Chrysler Building

New York City, USA

1,046 feet (319 meters) high

Completed 1930

Designed by William Van Alen

The Chrysler Building is a classic example of Art Deco architecture. Adorned with fenders, hub caps, and American eagles, and topped with a gleaming stainless-steel crown, it's an ode to the US automobile industry of the early 20th century. It was the world's tallest skyscraper for only 11 months, overtaken in 1931 by the Empire State Building, but its elegance renders the Chrysler Building a much-loved feature of the New York skyline.

"To re-create the ornamental features, we had to find the most appropriate LEGO® pieces. The triangular windows on the tower's crown are made from wings from a spaceship and the fronts of cars."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



CN Tower

Toronto, Canada

1,815 feet (553 meters) high

Completed 1976

Designed by John Andrews, WZMH Architects

The CN Tower is a thrill-seeker's delight, with a number of vertigo-inducing attractions. The world's highest external 'edge walk' allows you to circumnavigate the building—completely hands free!—1,168 feet (350 meters) above the ground. You can climb even higher in an elevator that travels through the tower's upper core to the SkyPod observation platform, a breathtaking 1,467 feet (447 meters) above the city.

"This tower is a crazy shape—it looks like a UFO landed in the middle of Toronto. We made the donut-like ring with bumper bars from LEGO® cars."

—Ryan McNaught, LEGO® certified professional



Comcast Technology Center

Philadelphia, USA

1,121 feet (342 metres) high

To be completed 2018

Designed by Foster + Partners

Envisaged as a vertical Silicon Valley, the Comcast Technology Center is Philadelphia's tallest skyscraper. A slender illuminated glass shaft extends 126 feet (38 meters) above the tower into the sky, and glass curtain walls allow natural light to stream through the interior. Designed to be a building for the future, it features punched stainless-steel panels that offer a nod to Philadelphia's manufacturing past.

"This tower was interesting architecturally as it features a lot of glass and interior gardens, and we tried as much as possible to relay that in the model."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Empire State Building

New York City, USA

1,454 feet (443 meters) high

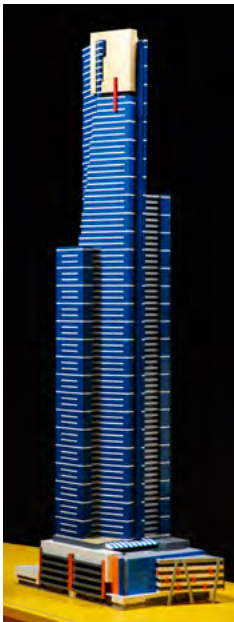
Completed 1931

Designed by Shreve, Lamb & Harmon Associates

If New York City were a chessboard, the Empire State Building would be the king, with the Chrysler Building its queen. Built more than 85 years ago, it's one of the world's most iconic skyscrapers, and was the tallest building in the world for 41 years. With its Art Deco style and ornamental spire, the Empire State Building remains an enduring symbol of the American spirit.

“First we had to decide whether to include King Kong, but there's so much more to this famous tower! If you look carefully, you can see we used dinosaur claws in front of knights' shields to achieve some of the Art Deco ornamentation.”

—Ryan McNaught, LEGO® certified professional



Eureka

Melbourne, Australia

975 feet (297 meters) high

Completed 2006

Designed by Nonda Katsalidis, Fender Katsalidis Architects

A retractable glass viewing cube which protrudes from the 88th floor allows a dizzying view as you hover 984 feet (300 meters) above the city. The tower's name was inspired by the miners' uprising at the Eureka Stockade during the gold rush of the 1850s, a pivotal event in Australia's history. The distinctive red stripe represents the blood shed during this battle, while the gold crown captures the light of the setting sun.

“The great thing about Eureka Tower, apart from its being in Melbourne where I live, is that we got to use gold bricks, which are truly rare and precious in LEGO® world. If only they were real gold!”

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



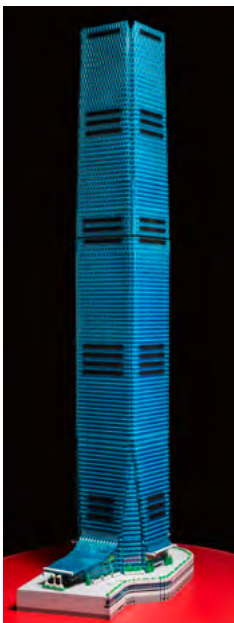
Infinity Tower

Brisbane, Australia
817 feet (249 meters) high
Completed 2014
Designed by DBI Design

Embellished with white horizontal lines, vertical dashes and spiraling grooves that joyously etch the building, the Infinity Tower is a standout on Brisbane's skyline. Tall, slim, and cylindrical, the tower is able to deflect the powerful storms and gusty winds that regularly batter this subtropical region.

"It sounds strange, but the Infinity Tower is covered in SNOT (a well-used LEGO® term meaning 'studs not on top'). You'd never guess, but the tower is actually built sideways so we could get those long, narrow, vertical lines and a smooth cylindrical shape overall."

—Ryan McNaught, LEGO® certified professional



International Commerce Tower

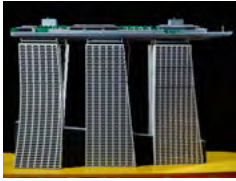
Hong Kong, China
1,588 feet (484 meters) high
Completed 2010
Designed by Kohn Pedersen Fox Associates

Imagine a dragon covered in scales of glass, its tail gently resting on the ground. Hong Kong's International Commerce Centre is beautiful, refined, and understated. It also employs cutting-edge aerodynamics: its shingles function like aircraft flaps, deflecting gale-force winds.

"We thought this one would be simple but we were sorely mistaken. Its vast hinged walls slope inwards and outwards and there's a notched channel down each side. What I'm most proud of is the intense color we got from placing 'trans blue' glass over a background of 'earth blue' bricks."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Marina Bay Sands

Singapore

656 feet (200 meters) high

Completed 2010

Designed by Moshe Safdie, Safdie Architects

Resembling a six-legged creature prowling the shoreline, this awe-inspiring skyscraper is definitely a head turner. Oddly perched upon inward-sloping towers, a 2.96 acre (1.2-hectare) platform contains landscaped greenery, restaurants, and a vast infinity pool. This SkyPark rests on an automated cradle that can adjust to even the slightest building movement from wind or earth tremors.

“Marina Bay Sands has never been done in LEGO® bricks at this scale and I can see why. Each supporting tower curves upwards like a banana. Some get thinner, others get thicker, some grow narrower, others grow wider. And then of course they all join in together. It proves what they say, ‘LEGO® doesn’t like curves.’”

—Ryan McNaught, LEGO® certified professional



Petronas Twin Towers

Kuala Lumpur, Malaysia

1,483 feet (452 meters) high

Completed 1996

Designed by César Pelli

Like a pair of mighty rocket ships ready to blast into space, the Petronas Twin Towers building is both otherworldly and culturally grounded. The towers feature a series of interlocked circles and squares, based on the traditional Islamic star motif known as the “Rub el Hizb,” which stack upwards into the sky.

“Keen-eyed LEGO® fans will see that we built this model upside down. To get the glass bricks looking clean and sharp we needed the studs facing downwards. It’s not your ‘everyday’ LEGO® building, and it’s probably the craziest technique used in the whole project.”

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Q1

Gold Coast, Australia

1,058 feet (323 meters) high

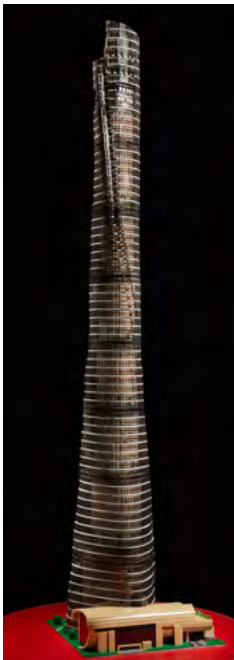
Completed 2005

Designed by Sunland Design Group and Innovarchi

Located in the heart of Surfers Paradise, Q1 is the tallest building in Australia, soaring high above the sand, surf, sun-tanned bodies, and holiday glitz of Queensland's Gold Coast. The Q1 features Australia's highest external building climb experience, taking you 886 feet (270 meters) above the ground.

"For me, the color scheme really pops. A combination of dark blue, mid blue and white makes the Q1 sparkle like a jewel. It's always hard to pick favorites, but this one comes pretty close."

—Ryan McNaught, LEGO® certified professional



Shanghai Tower

Shanghai, China

2,073 feet (632 meters) high

Completed 2015

Designed by Gensler

Majestically tapering upwards and twisting 120 degrees as it goes, this so called "vertical city" is actually a building wrapped in a "second skin." In the space between, nine separate "sky-lobbies" or neighborhoods provide residents with fresh air, gardens, and simulated "outdoor living" areas far above the bustle of Shanghai below. At a staggering 2,073 feet (632 meters) high, Shanghai Tower is China's tallest building.

"This building was a mind-bender. It's basically a model with 80 separate LEGO® layers, each shaped like a guitar pick. Inside it's like a random stack of tin cans surrounded by trees and beams. Because the outer skin is transparent we had to create a lot of internal details as well."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Taipei 101

Taipei, Taiwan

1,167 (509 meters) high

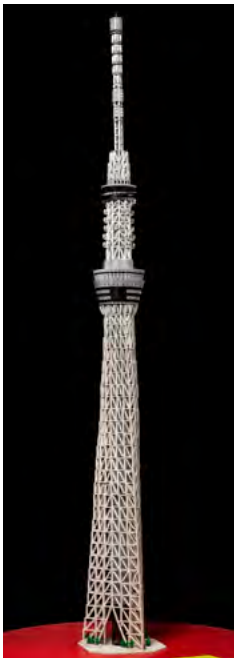
Completed 2004

Designed by CY Lee and Partners

To some people, Taipei 101 looks like a stem of green bamboo. To others it's a pile of precariously stacked noodle boxes. Able to withstand earthquakes and typhoons, commonplace in Taiwan, this building can sway, literally. A giant pendulum suspended down its center works to counteract external forces, keeping the tower upright.

"The big challenge with Taipei 101 was its color. The actual building changes color throughout the day from dark green to deep blue. The perfect LEGO® color was a shade called 'dark azure', but it was too rare to use. We finally went with 'dark gray', which we've tweaked with clever lighting."

—Ryan McNaught, LEGO® certified professional



Tokyo Skytree

Tokyo, Japan

2,080 feet (634 meters) high

Completed 2012

Designed by Nikken Sekkei

In a city famous for robots, sci-fi movies, and visionary technology, it's no surprise that Tokyo's tallest building also beams TV and radio signals far and wide. Its distinctive engineering references traditional craftsmanship and culture, blending Japan's past, present, and future. A crisscross of interlaced tubular columns enables the Skytree to withstand Tokyo's high winds and seismic activity, and the occasional rampaging monster!

"This is one of the craziest towers in the exhibition. For the lattice we developed a cool system of 'jumper plates' and 'hinged elements' to make the crisscross work properly, as well as allowing the shape to change from a triangle at the bottom to a circle at the top."

—Ryan McNaught, LEGO® certified professional

TOWER DESCRIPTIONS



Willis Tower (Sears Tower)

Chicago, USA

1,730 feet (443 meters) high

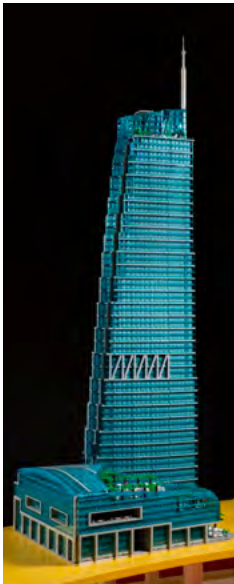
Completed 1974

Designed by Skidmore, Owings & Merrill

Resembling a pile of staggered building blocks, the Willis Tower was known as Sears Tower until 2009. The structure is clad in bronze-tinted windows framed in black aluminum, and its austere profile creates a monolithic presence and striking silhouette on Chicago's skyline.

"This tower was one of my personal favorites. To get the tower's distinctive color we used black bricks behind smoky glass."

—Ryan McNaught, LEGO® certified professional



Wilshire Grand Center

Los Angeles, USA

1,100 feet (335 meters) high

Completed 2017

Designed by AC Martin

Reflecting the city's bright blue skies, the Wilshire Grand Center marks the start of a new era of tall contemporary buildings in downtown Los Angeles. With its shining glass facade, sail-shaped roof and elegant spire, the design provides a striking contrast to the surrounding boxy concrete towers that were constrained by building codes of the past.

"With its crazy slopes and curves, and flowing river of glass between the tower and podium, the Wilshire Grand presented a lot of unique features that are difficult to translate with LEGO®. This was the hardest tower to make after the Burj Khalifa."

—Ryan McNaught, LEGO® certified professional

EXTERNAL RESOURCES



URBAN DESIGN

Nature Works Everywhere

Sustainable Cities: Nature-Based Solutions in Urban Design

natureworkseverywhere.org/resources/sustainable-cities

Cube Education

Cube Lesson Plans

cube-education.org/initiatives

Canadian Geographic Education

Habitats: Design Your Own Suburb

cangeoeducation.ca/resources/learning_centre/classroom_activities/habitat_suburb.asp

Canadian Institute of Planners

A Kid's Guide to Building Great Communities: A Manual for Planners and Educators

cip-icu.ca/Files/Resources/kidsguide.aspx

Planning Vancouver Together

Vancouver's Collaborative City Plan

vancouverplan.ca

Ecocities Emerging

Transforming Oakridge Shopping Mall into an Ecocity Fractal

ecocitiesemerging.org/ecocities-emerging-in-vancouver-transforming-oakridge-shopping-mall-into-an-ecocity-fractal/

Streetmix

streetmix.net/-/1058899

EXTERNAL RESOURCES



STRUCTURAL ENGINEERING

How Stuff Works

5 Things LEGO® Blocks Can Teach You About Structural Engineering

science.howstuffworks.com/engineering/structural/5-things-lego-blocks-teach-structural-engineering.htm#page=0

Science World Resources

Gum-drop Structures

scienceworld.ca/resource/gum-drop-structures

Eggstra Strong Eggs

scienceworld.ca/resource/eggstra-strong-eggs

Marshmallow House Challenge

scienceworld.ca/resource/marshmallow-house-challenge

Building and Testing Earthquake-Proof Structures

scienceworld.ca/resource/building-and-testing-earthquake-proof-structures

Shape Scavenger Hunt

scienceworld.ca/resource/shape-savenger-hunt