In 1956,

architect Frank Lloyd Wright

proposed a mile-high skyscraper.

It was going to be the world’s tallest building,

by a lot —

five times as high as the Eiffel Tower.

But many critics \_\_\_\_\_\_ at the architect,

arguing that people would have to wait hours for an elevator,

or worse, that the tower would **collapse** under its own weight.

Most engineers agreed,

and despite the **publicity** around the proposal,

the **titanic** tower was never built.

But today,

bigger and bigger buildings are going up around the world.

Firms are even planning \_\_\_\_\_\_\_ more than a kilometer tall,

like the Jeddah Tower in Saudi Arabia,

three times the size of the Eiffel Tower.

Very soon,

Wright’s mile-high miracle may be a reality.

So what exactly was \_\_\_\_\_\_\_ us

from building these **megastructures** 70 years ago,

and how do we build something a mile high today?

In any construction project,

each story of the structure needs to be able to \_\_\_\_\_\_\_\_ the stories on top of it.

The higher we build,

the higher the gravitational **pressure** from the upper stories on the lower ones.

This principle has long **dictated** the shape of our buildings,

leading \_\_\_\_\_\_\_ architects to favor pyramids with wide foundations

that support lighter upper levels.

But this solution doesn’t quite translate to a city **skyline**–

a pyramid that tall would be roughly one-and-a-half miles wide,

tough to **squeeze** into a city center.

Fortunately, strong \_\_\_\_\_\_\_\_\_ like concrete can avoid this **impractical** shape.

And modern concrete **blends** are **reinforced** with steel-fibers for strength

and water-reducing polymers to prevent cracking.

The concrete in the world’s tallest tower, Dubai’s Burj Khalifa,

can **withstand** about 8,000 tons of pressure per square meter–

the weight of over 1,200 African \_\_\_\_\_\_\_!

Of course, even if a building supports itself,

it still needs support from the ground.

Without a **foundation**,

buildings this heavy would sink, fall, or **lean** over.

To prevent the roughly half a million ton tower from sinking,

192 \_\_\_\_\_\_\_ and steel supports called piles were buried over 50 meters deep.

The friction between the piles and the ground

keeps this sizable structure standing.

Besides defeating gravity,

which pushes the building down,

a skyscraper also needs to **overcome** the **blowing** \_\_\_\_\_\_,

which pushes from the side.

On average days,

wind can **exert** up to 17 pounds of force per square meter on a high-rise building–

as heavy as a **gust** of bowling balls.

Designing \_\_\_\_\_\_\_ to be aerodynamic,

like China’s sleek Shanghai Tower,

can reduce that force by up to a quarter.

And wind-**bearing frames** inside or outside the building

can absorb the remaining wind force,

such as in Seoul’s Lotte Tower.

But even after all these \_\_\_\_\_\_\_\_,

you could still find yourself **sway**ing back and forth

more than a meter on top floors during a hurricane.

To \_\_\_\_\_\_\_ the wind from **rock**ing tower tops,

many skyscrapers employ a counterweight weighing hundreds of tons

called a “tuned mass **damper**.”

The Taipei 101, for instance,

has **suspended** a giant metal orb above the 87th floor.

When wind moves the building,

this **orb** \_\_\_\_\_\_\_\_ into action,

absorbing the building’s kinetic energy.

As its movements **trail** the tower’s,

hydraulic cylinders between the ball and the building

convert that kinetic energy into heat,

and **stabilize** the swaying structure.

With all these \_\_\_\_\_\_\_ in place,

our mega-structures can stay standing and stable.

But quickly traveling through buildings this large is a challenge in itself.

In Wright’s age,

the fastest elevators moved a mere 22 kilometers per hour.

Thankfully, today’s elevators are much faster, traveling over 70 km per hour

with future cabins \_\_\_\_\_\_\_\_ using frictionless magnetic rails

for even higher speeds.

And traffic management algorithms group **rider**s by **destination**

to get passengers and empty cabins where they need to be.

Skyscrapers have come a long way since Wright proposed his mile-high tower.

What were once considered impossible ideas

have become architectural opportunities.

Today it may just be a matter of time

until one building goes the extra mile.