

A tall skyscraper under construction in a city. The building has a blue glass facade and a red steel framework at the top. It is surrounded by other buildings of various colors and heights. The sky is blue with some clouds.

So You Need To...

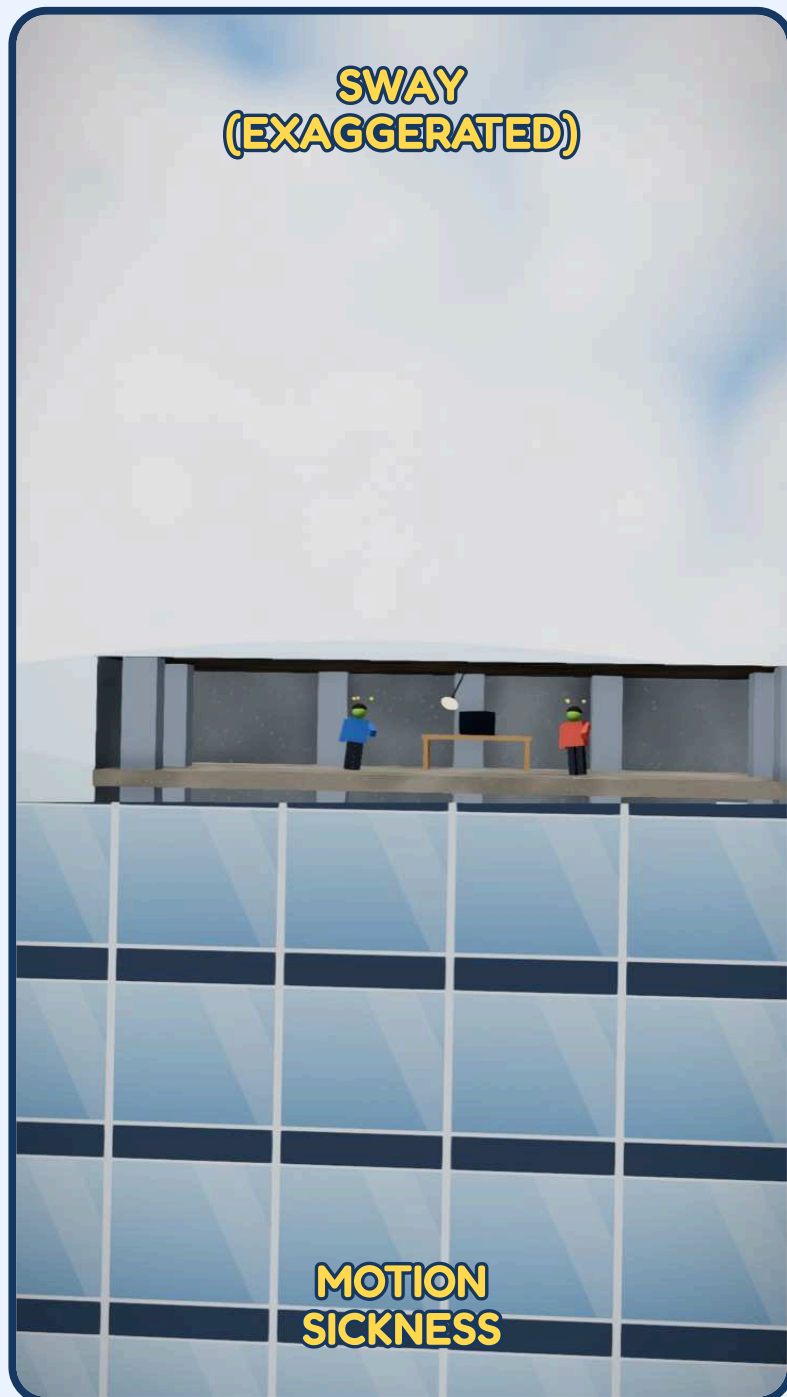
keep a skyscraper standing



You need to keep a
skyscraper
standing.

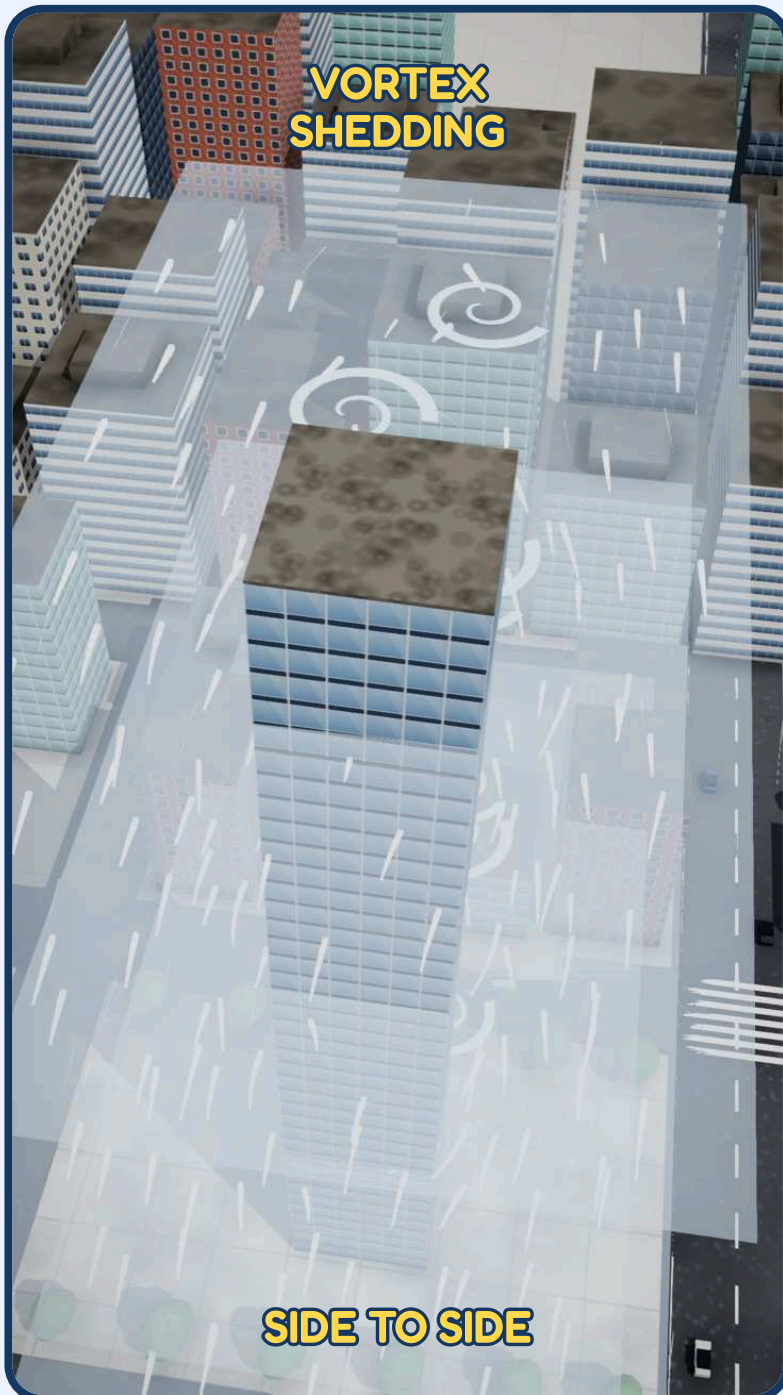
You're building a skyscraper.
Wind and earthquakes will both
try to knock it over.

A tall, thin tower is a giant
lever. Wind pushes on its whole
height, and the base takes all
that bending.



But the top sways.

And people up there feel seasick.



But wind peels off
the sides in
swirling vortices.

One side, then the other,
rocking the tower.



So you shape the tower.

Round or notch the corners, and taper it with setbacks as it rises.

Now the vortices fall out of step, and the rocking fades.

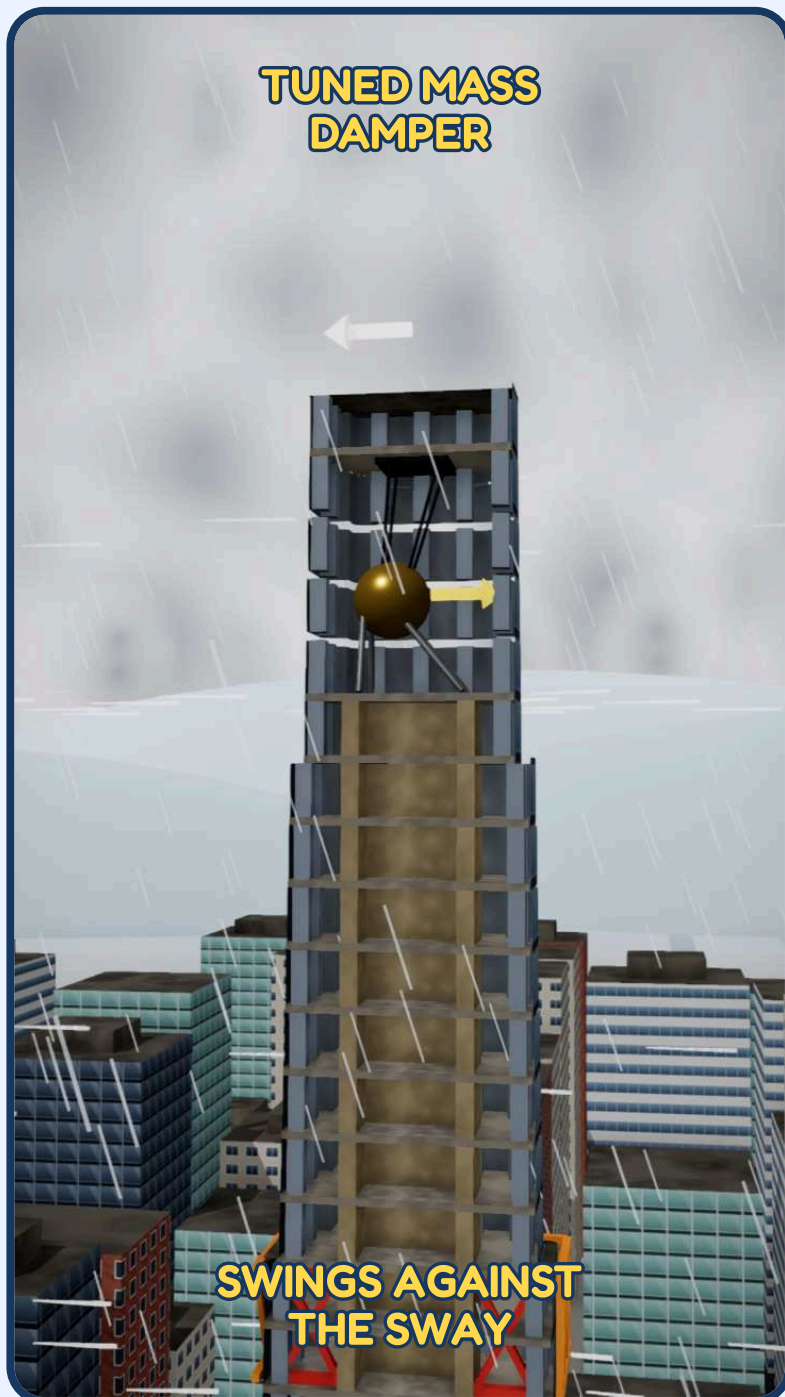


But it still bends.

So you add a stiff concrete core.

Giant outrigger trusses tie the core to a belt around the outer columns.

Now the core can't bend alone. The outer columns push and pull against it.

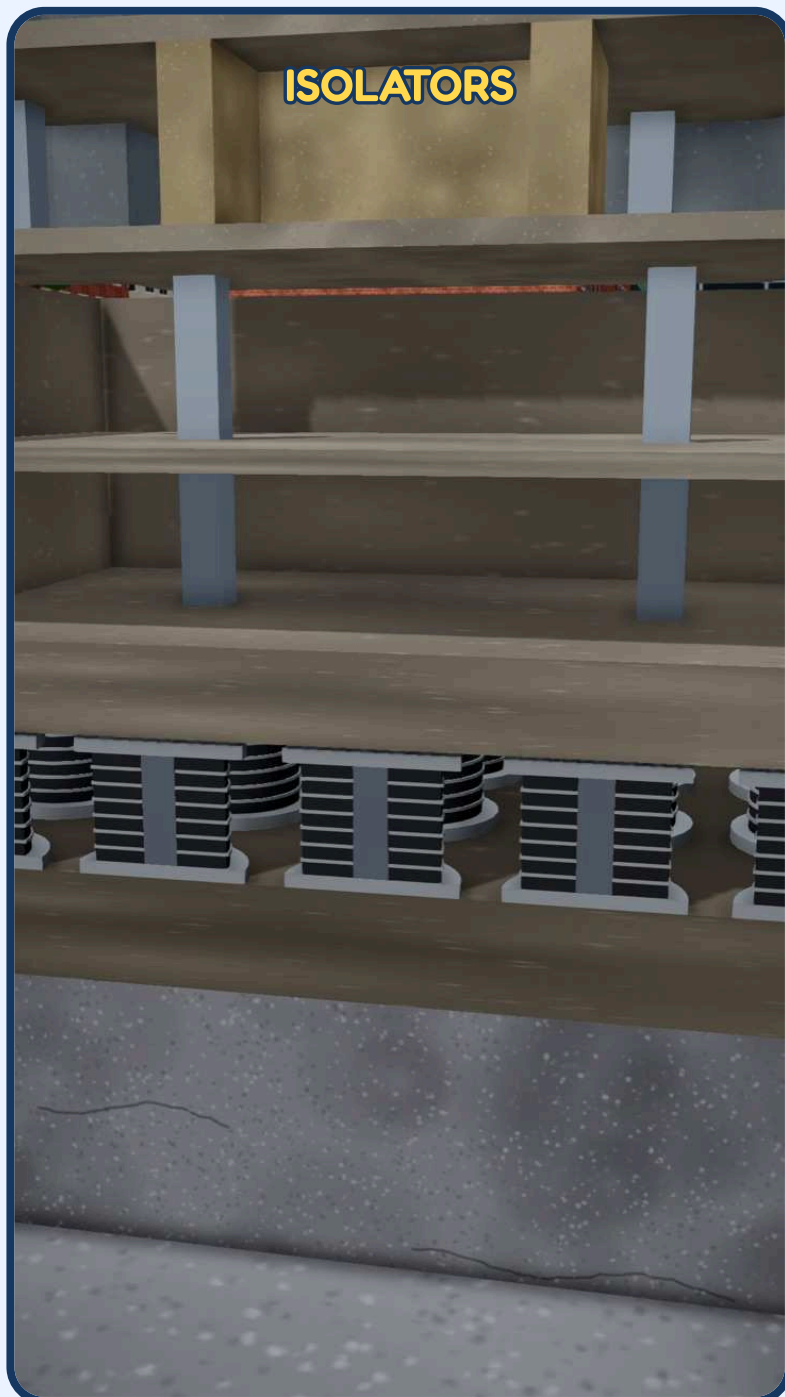


But in a storm, the top still drifts.

So you hang a giant weight near the top.

It's tuned to the tower's rhythm. When the tower leans one way, the weight swings the other, calming the motion.

In Taiwan's tallest tower, Taipei 101, the weight is 660 tonnes.

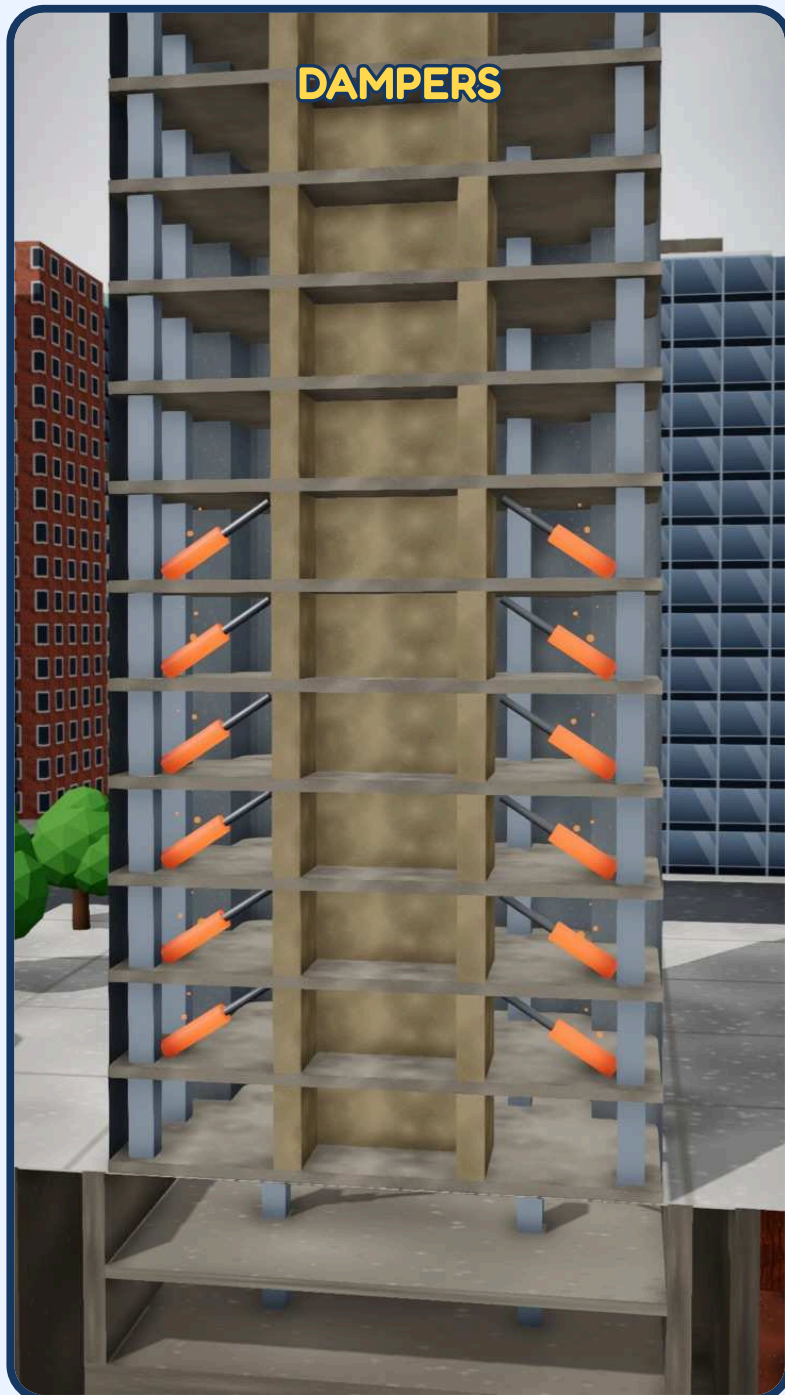


But then the ground strikes.

So some towers sit on isolators.

An earthquake shakes the tower from below. Isolators are layers of rubber and steel.

The ground lurches, the rubber flexes, and the building above moves far less.



And dampers in the frame turn what's left into heat.

A skyscraper doesn't survive by standing still. It survives by moving the right way.

The short version

You need to keep a skyscraper standing.

But the top sways.

But wind peels off the sides in swirling vortices.

So you shape the tower.

But it still bends.

So you add a stiff concrete core.

But in a storm, the top still drifts.

So you hang a giant weight near the top.

But then the ground strikes.

So some towers sit on isolators.

And dampers in the frame turn what's left into heat.

A skyscraper doesn't survive by standing still. It survives by moving the right way.

Sources

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Dampers turning motion into heat

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