When a wheel is rolling without slipping, as we saw before, that the contact point here, the contact point is instantaneously at rest.

Now, if the wheel is rolling on a surface with friction, then it's possible that we may have a static friction force.

So there could be static friction may act.

However, static fiction is always depends on the circumstances.

Now let's just consider two cases.

Suppose here's a wheel, Vcm.

This is a horizontal surface.

And in that case, the static friction, if the wheel is rolling with velocity V, in this case f static is 0.

And because of that, the wheel will roll without any friction, which is an idealization.

There's other types of friction called rolling resistance, air resistance, et cetera, which will slow the wheel down.

But in a perfect hard wheel, idealized wheel in a vacuum, it will keep on rolling.

However, if a wheel is going down an incline plane and it wants to maintain the rolling without slipping condition-- so here we have Vcm.

And it has some angular speed-- we have to be careful because in this case if we differentiate Acm is our alpha.

So what is making the wheel spin faster?

It has a non-zero, angular acceleration.

And if we looked at the forces acting on the wheel, then we have a normal force.

We have gravity acting at the center of mass.

And we also have static friction.

And it's precisely the static friction that is producing a torque about the center of mass.

And that torque about the center of mass will produce an angular acceleration.

So in order for the wheel to continue rolling without slipping, it must have both a linear acceleration, which comes from gravitational force component going down an inclined plane minus the friction plus the alpha is coming from the torque.

And so this side, if we wrote it as a vector equation, the torque about the center of mass would be the vector from-- let's right this is r cm to where the static friction is acting.

So that's the vector r cm F static cross f static.

So in this case, f static is non-zero.

So there are many circumstances in which static friction can vary between a zero value, some possible value, and some maximum value.

And here we see one more example.

In order for the wheel to continue to accelerate down the inclined plane and roll without slipping that the static friction must produce a torque that causes the angular acceleration.

And so we see that static friction depends on the other constraints in the problem.