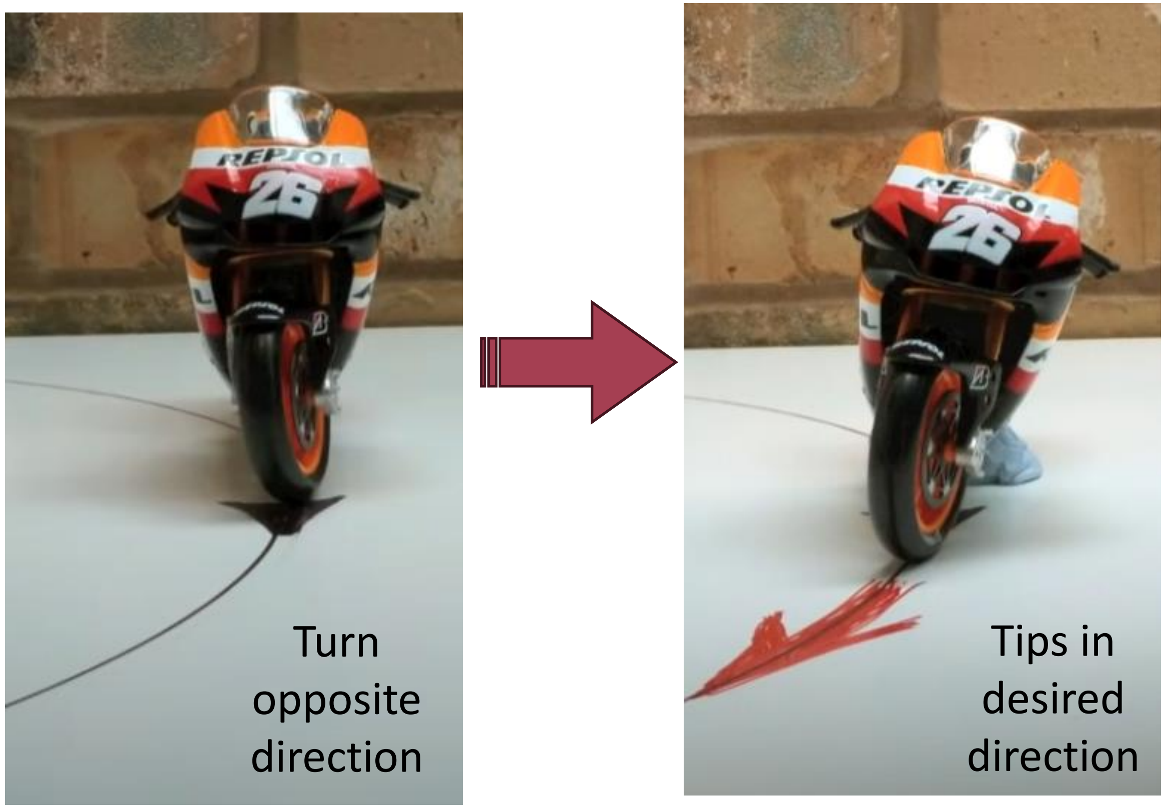
BEST PRACTICE RIDING SKILLS FOR THE TWISTIES

TOPICS

- Counter Steering
- Trail Braking
- Body Position

- COUNTER STEERING -

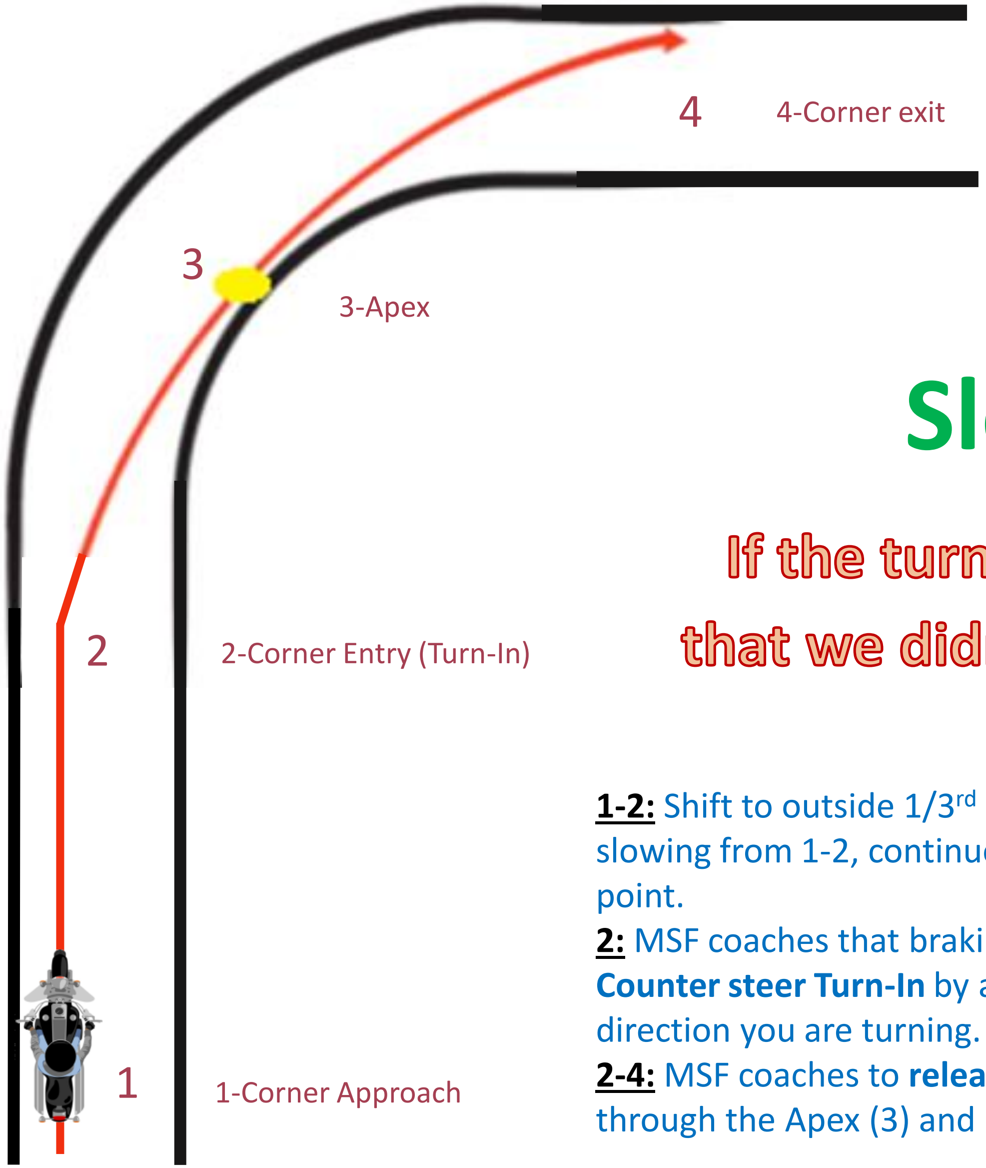
Fort 9: https://youtu.be/vSZiKrtJ7Y0?si=161jkfyfXKdK_btU



Counter steering 101:
https://youtu.be/C848R9xWrjc?si=KbJ0Ww4WYoGfxWuP

- TRAIL BAKING-

[Canyon Chasers: https://www.youtube.com/watch?v=gPE67XqGsV4](https://www.youtube.com/watch?v=gPE67XqGsV4)



MSF

Slow, Look Press and Roll

If the turn is blind or we encounter a hazard (e.g. gravel) that we didn't see until after corner entry, what do we do?

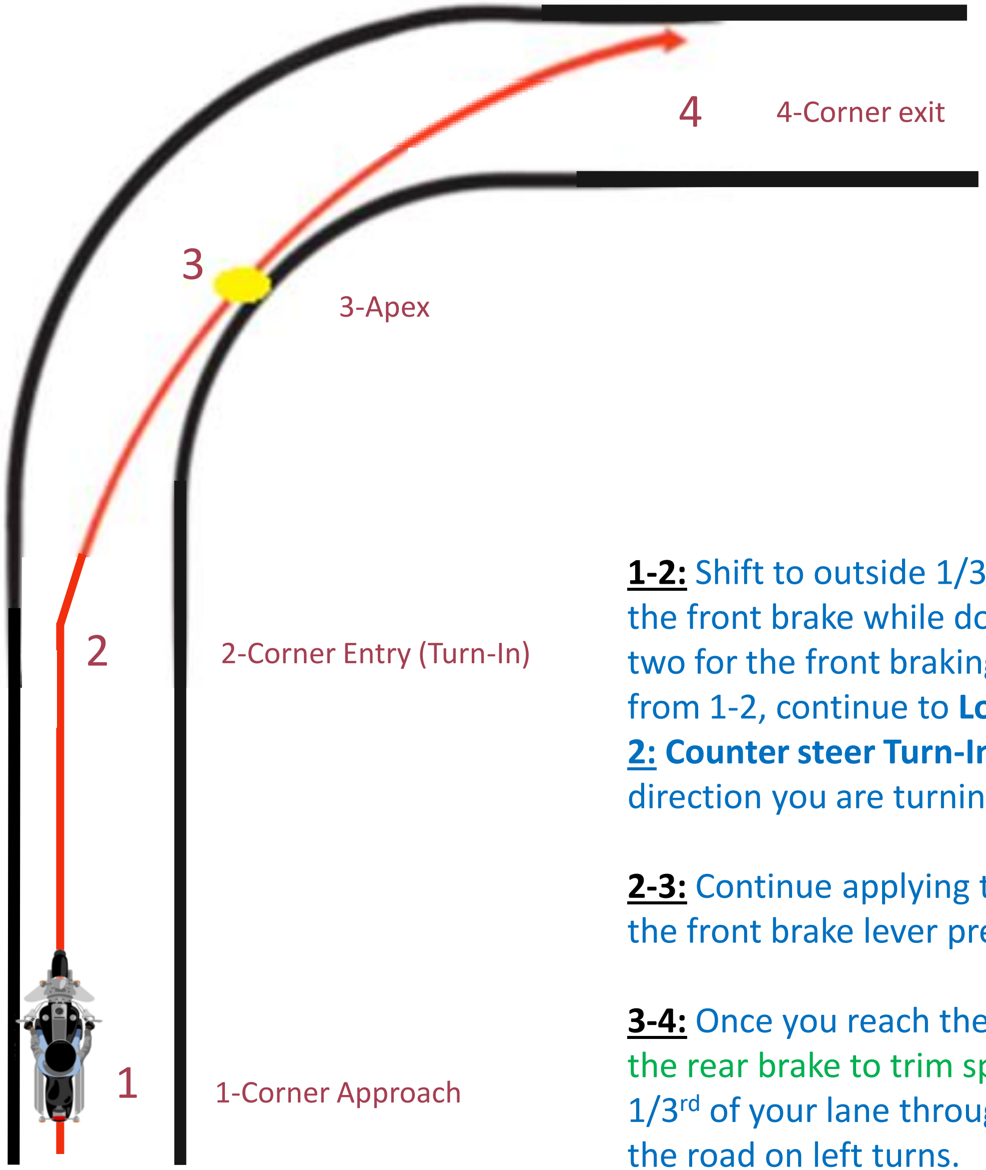
1-2: Shift to outside 1/3rd of your lane. **Slow** upright without lean angle (front brake/back brake/down-shift). While slowing from 1-2, continue to **Look** through the corner for Exit (4) & Apex (3) to choose the optimal (2) **Turn-In** point.

2: MSF coaches that braking to the slowest speed should have been completed before turning in at the Entry (2). **Counter steer Turn-In** by applying forward pressure (**Press**) on the same side of the handle bar that is in the direction you are turning.

2-4: MSF coaches to **release the brakes** and steadily **Roll** on or **maintain** the throttle after turning in at the Entry (2) through the Apex (3) and Exit (4).

MSF Operation Manual: (https://www.msf-usa.org/downloads/mom_v16_color_hi_res.pdf)

Trail Braking a 90 degree Turn

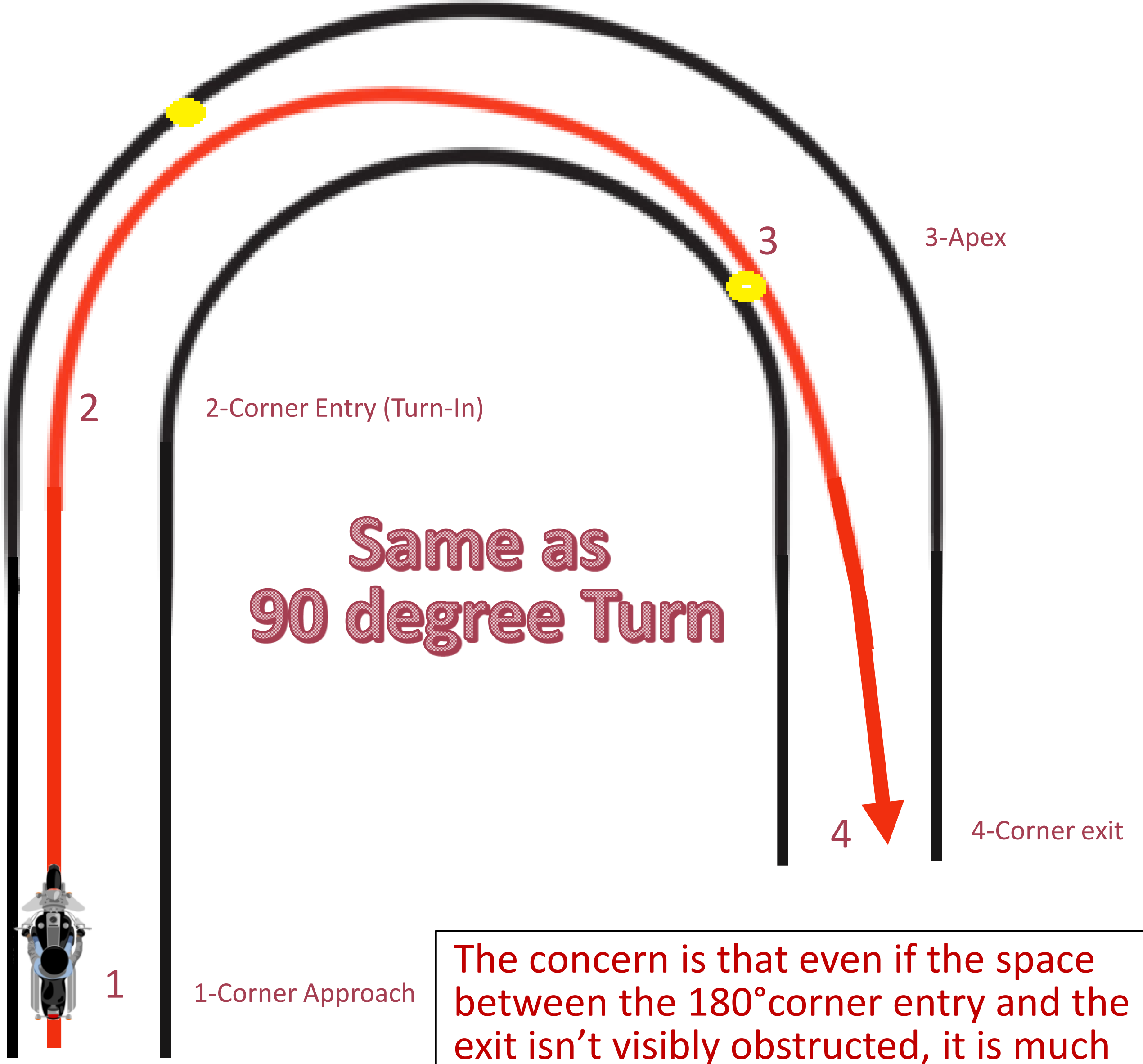


1-2: Shift to outside 1/3rd of road. **Slow** upright without lean angle primarily utilizing the higher braking power of the front brake while down-shifting to also add engine breaking. "**Wait for the weight**" means providing a second or two for the front braking to transfer the motorcycle/rider weight to front tire before turning in (2). While slowing from 1-2, continue to **Look** through the corner for Exit (4) & Apex (3) to choose the optimal (2) **Turn-In** point.
2: Counter steer Turn-In by applying forward pressure (**Press**) on the same side of the handle bar that is in the direction you are turning.

2-3: Continue applying the front brake through the Corner Entry (2) and to the Apex (3), but progressively reduce the front brake lever pressure as you increase lean angle (i.e., **Trail brake**).

3-4: Once you reach the Apex (3), smoothly **roll** on the throttle [optionally while simultaneously trail braking with the rear brake to trim speed from the Apex (3) to the Exit (4)] at a rate that ensures that you stay within the outside 1/3rd of your lane through the Exit (4) and not accidentally crossing over into the oncoming lane on right turns or off the road on left turns.

Trail Braking a 180 degree Turn



The concern is that even if the space between the 180°corner entry and the exit isn't visibly obstructed, it is much harder to see all of the potential hazards through the turn. Trail braking enables us to adapt our speed at any point through such a corner.

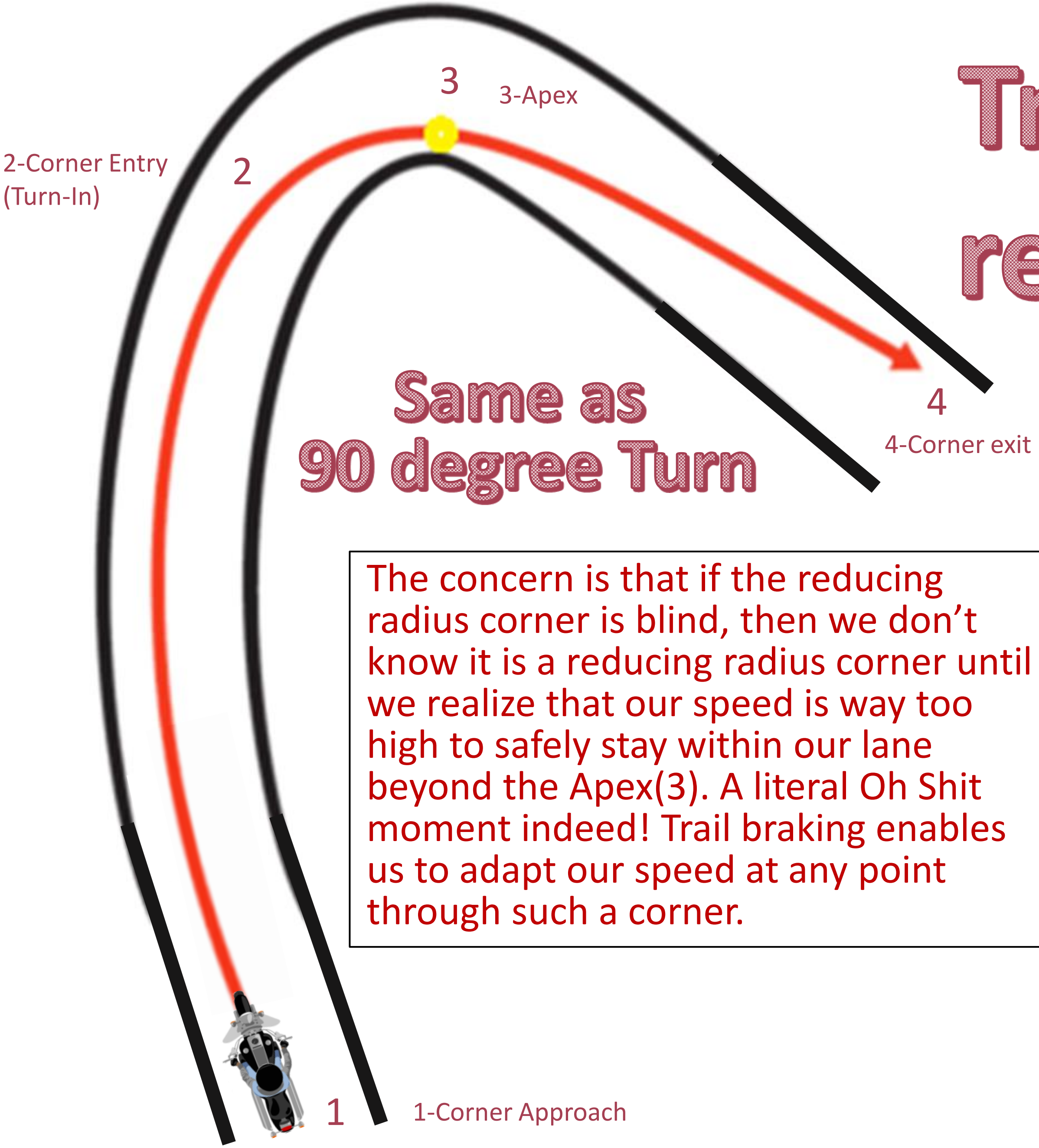
1-2: Shift to outside 1/3rd of road. **Slow** upright without lean angle primarily utilizing the higher braking power of the front brake while down-shifting to also add engine breaking. "**Wait for the weight**" means providing a second or two for the front braking to transfer the motorcycle/rider weight to front tire before turning in (2). While slowing from 1-2, continue to **Look** through the corner for Exit (4) & Apex (3) to choose the optimal (2) **Turn-In** point.

2: **Counter steer Turn-In** by applying forward pressure (**Press**) on the same side of the handle bar that is in the direction you are turning.

2-3: Continue applying the front brake through the Corner Entry (2) and to the Apex (3), but progressively reduce the front brake lever pressure as you increase lean angle (i.e., **Trail brake**).

3-4: Once you reach the Apex (3), smoothly **roll** on the throttle [optionally while simultaneously trail braking with the rear brake to trim speed from the Apex (3) to the Exit (4)] at a rate that ensures that you stay within the outside 1/3rd of your lane through the Exit (4) and not accidentally crossing over into the oncoming lane on right turns or off the road on left turns.

Trail Braking through a reducing Radius Corner



Same as 90 degree Turn

The concern is that if the reducing radius corner is blind, then we don't know it is a reducing radius corner until we realize that our speed is way too high to safely stay within our lane beyond the Apex(3). A literal Oh Shit moment indeed! Trail braking enables us to adapt our speed at any point through such a corner.

1-2: Shift to outside 1/3rd of road. **Slow** upright without lean angle primarily utilizing the higher braking power of the front brake while down-shifting to also add engine breaking. "**Wait for the weight**" means providing a second or two for the front braking to transfer the motorcycle/rider weight to front tire before turning in (2). While slowing from 1-2, continue to **Look** through the corner for Exit (4) & Apex (3) to choose the optimal (2) **Turn-In** point.

2: Counter steer Turn-In by applying forward pressure (**Press**) on the same side of the handle bar that is in the direction you are turning.

2-3: Continue applying the front brake through the Corner Entry (2) and to the Apex (3), but progressively reduce the front brake lever pressure as you increase lean angle (i.e., **Trail brake**).

3-4: Once you reach the Apex (3), smoothly **roll** on the throttle [optionally while simultaneously trail braking with the rear brake to trim speed from the Apex (3) to the Exit (4)] at a rate that ensures that you stay within the outside 1/3rd of your lane through the Exit (4) and not accidentally crossing over into the oncoming lane on right turns or off the road on left turns.

- BODY POSITION-

MotoJitsu: https://youtu.be/P7Y5GtRltVs?si=B_03O069aeaJsRNA

Physics of Counter steering:
https://youtu.be/PgUOOwnZcDU?si=hK3VbPifkt9RBjkg

Centripetal Force

Any motion in a curved path represents accelerated motion, and requires a force directed toward the center of curvature of the path. This force is called the centripetal force which means "center seeking" force. The force has the magnitude

$$F_{centripetal} = m\frac{v^2}{r}$$

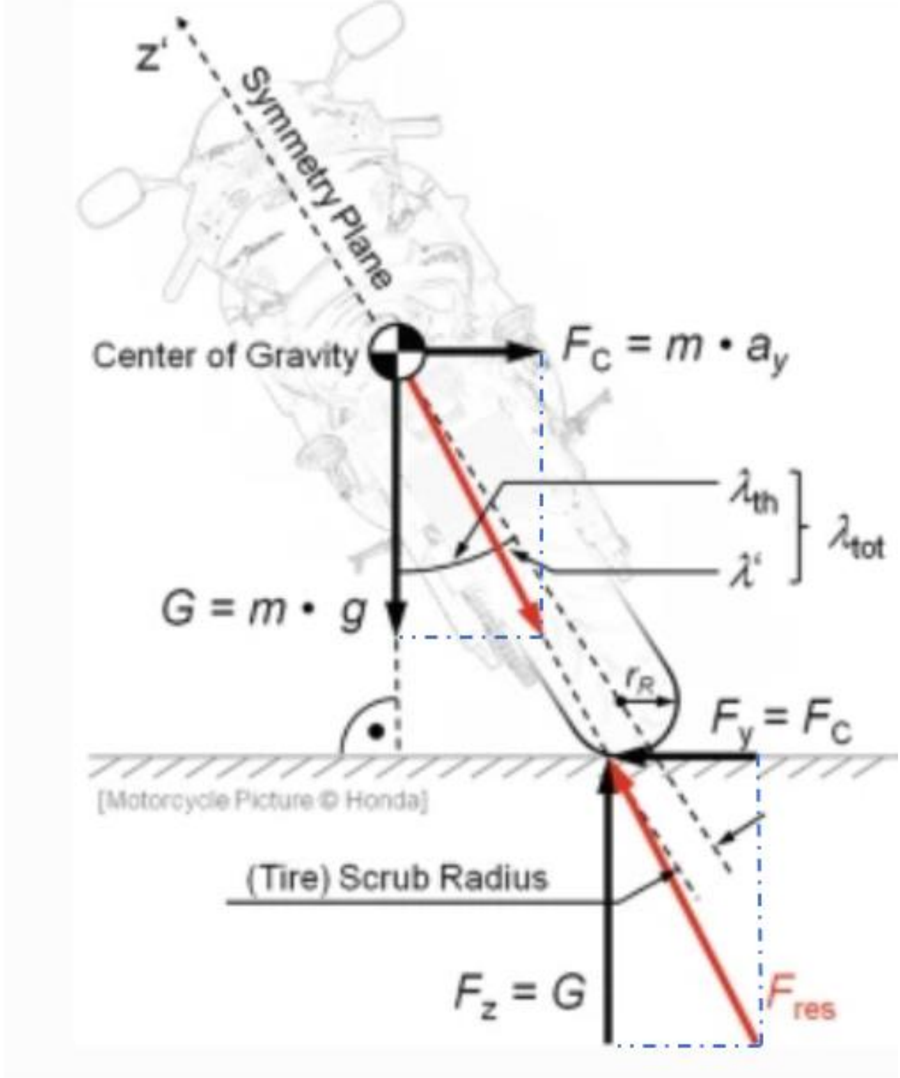
Swinging a mass on a string requires string tension, and the mass will travel off in a tangential straight line if the string breaks.

The centripetal acceleration can be derived for the case of circular motion since the curved path at any point can be extended to a circle.

$$F_{centripetal} = m\frac{v^2}{r}$$

$\frac{v^2}{r}$ is the centripetal acceleration

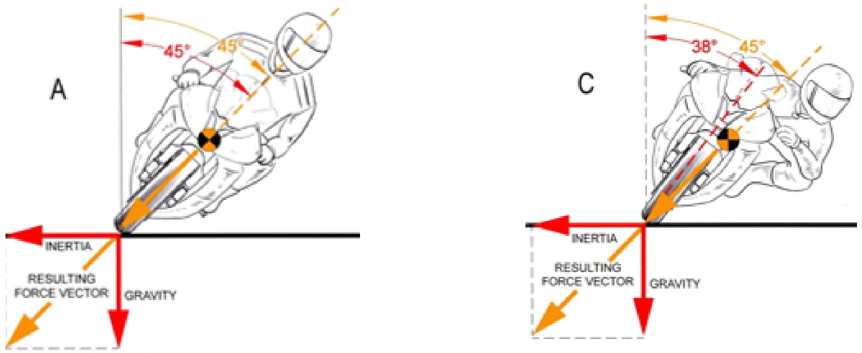
Note that the centripetal force is proportional to the square of the velocity, implying that a doubling of speed will require **four times** the centripetal force to keep the motion in a circle. If the centripetal force must be provided by friction alone on a curve, an increase in speed could lead to an unexpected skid if friction is insufficient.



g *= gravitational acceleration &* ***G*** *= Gravitational Force = Weight*

m *= mass of bike & rider*

a_y *= acceleration due to changing momentum in a curve =* v^2/r*;*
~ where ***v*** *= velocity of bike and* ***r*** *= turn's radius.*



The centripetal or "centrifugal" force is also referred to as Inertia in the above diagrams A and C.

A. The racer is in the "Standard" riding position. The Force Vector is at a 45° angle. Notice the center line chassis of the bike and forced vector are at the same angle.

C. Shows a racer in the new "Moto GP style Body Position. Notice, that this force vector is also at a 45° angle. But the chassis has the smallest lean angle of 38°.

When the racer moves some of his weight, to the inside of the turn, the only thing that will change is the bike's angle relative to vertical. *The more weight the racer moves off center, the more upright the bike will be in the corner.* Here's the important point to notice, the angle of the Force Vector is unchanged by changes in Body Position. Notice, the force vector is the combined force transferred to the tire contact patch. The Body Position does not change the force vector or the load the tire feels. The force vector angle is a result of speed and radius only.

The motorcycle will only respond to how much weight is moved off center and how far it is moved off center. The bike doesn't care if the weight is, the racer's head, his head and shoulders, Mid-section, butt, knee, and elbow, chest pointed into the turn, chest pointed straight ahead, head up or head down or if he is hanging a bowling ball off to the side.

Considering a motorcycle in a steady-state turn, we can analyze the forces acting on it in a free body diagram as shown in Figure 4-1. Weight is the main force (i.e., mass of bike & rider x acceleration due to gravity) acting on the motorcycle's center of gravity (CG) motorcycle = mg. The centripetal/"centrifugal" force (cp) acting at the motorcycle's tires is a result of the mass of the bike and rider multiplied by the acceleration due to changing momentum in a curve.

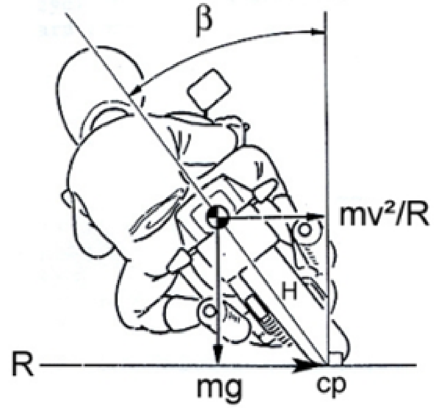


Figure 4-1 Free Body Diagram of Motorcycle in a steady-state turn

The free body diagram's **cp** is the "centrifugal" force since this **vector's** direction is pointing away from the center of the turn's radius.

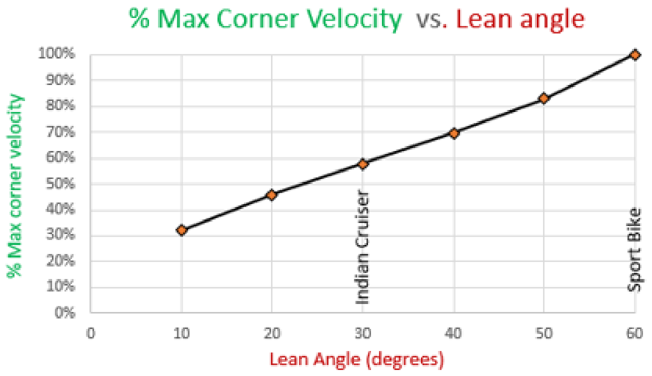
cp's magnitude is the same as the centripetal force, but opposite in direction:

cp = - mv²/r

In examining the free body diagram above, a **moment balance** performed about the motorcycle's contact patch yields an expression that relates the lean angle and corner velocity (a.k.a. speed) for a given corner radius.

$$\beta = \tan^{-1}\frac{v^2}{gR} \qquad v = \sqrt{Rg\tan(\beta)}$$

*~ where **v** = velocity*
*~ where **R** = corner radius*
*~ where **β** = lean angle*
*~ where **g** = acceleration due to gravity*



So, as we know from experience, the more we lean the rider/motorcycle to the inside of the corner, the faster we can go around that corner.

However, to avoid dragging our floorboards or pegs on our Indian bagger or cruiser, we can also lean our bodies while reducing the motorcycle's lean angle to increase corner speed while reducing the risk of dragging floor boards/pegs.

THANK YOU