Traction Control

You are driving to meet a friend in an area of town you that are not familiar with. Snow has been falling for several hours, and the roads are already slippery. You are having trouble locating your meeting-place, and decide to pull over and call your friend for clearer directions. You park your car safely on the side of the road and dial the phone. While talking to your friend, you glance in your rear-view mirror and see a minivan swerving around on the road, apparently out of control. The van seems to be unable to stop as it speeds towards where you have parked. Quickly, you re-start your car in an attempt to move out of the way. As the wayward van approaches, you press on the gas but cannot get moving; your wheels spin helplessly on the slippery surface. The van approaches and you brace for impact.

Safety features exist to help prevent this type of situation. Specifically, traction control helps drivers accelerate in low-friction or slippery conditions.

What is traction control?

Traction control is an active vehicle safety feature designed to help your vehicle make effective use of all the traction available on the road when accelerating in slippery conditions. It is important to remember that traction control cannot create traction if there is none. Rather, traction control helps prevent your wheels from spinning on low-friction surfaces.

Traction control monitors the wheels on the vehicle for potential "wheel slip". When a vehicle's wheels are slipping, you will feel like your tires are "spinning" but are unable to catch any grip on the road. When vehicle wheels are spinning, there is little chance of a controlled acceleration. When your traction control system senses that one or more of your wheels is about to slip, it corrects the problem by applying the appropriate amount of brake to that wheel.

A helpful comparison can be made with anti-lock braking systems (ABS). In fact, ABS setups are the foundation upon which traction control systems are built. ABS helps to prevent wheel slip when a vehicle is braking in slippery conditions, while traction control helps to prevent wheel slip when a vehicle is accelerating in slippery conditions.

Many vehicles today are equipped with traction control, ABS, and electronic stability control (ESC). These three braking technologies all address the need to improve traction between the vehicle's tires and the road. In addition, the use of common sensors, hydraulic brake modulators, and electronic control units (ECUs) makes this trio of technology particularly efficient in terms of internal space occupation and ease of installation.

When would traction control be useful?

Traction control is useful whenever you are trying to accelerate in low-friction conditions. These conditions include when roads are wet, snowy, icy, uneven, or poorly maintained. Some concrete examples of when traction control would be useful include the following:

- You are attempting to accelerate up a hill where the surface is loose and gravelly. Without traction control, your wheels spin and you begin to slide backwards.
- You hit a patch of slushy road that causes your wheels to lose traction. As a result, your vehicle slows down and begins to fishtail.
- Two of your wheels cross an icy section of road, causing them to spin and lose traction. As a result, your car turns sharply out of your control.
- You lose traction driving through a puddle. As a result, your vehicle cannot maintain its speed, leaving you in danger of being hit by other vehicles.
- You are trying to accelerate at a green light on a slick road with traffic approaching you from behind.

The usefulness of traction control is not reserved for off-road adventuring. Variable temperatures and seasonal changes often result in quickly-changing weather and can take a hard toll on road conditions. Traction control can give you extra support for driving safely in a variety of situations.

How does traction control work?

Traction control works similar to ABS and is often considered as a supplement to existing ABS setups. Both systems work to solve opposite problems associated with wheel slippage or wheel lockage. In fact, in most modern vehicles the traction control feature uses the same components as ABS, including wheel-speed sensors (sensors that measure the rotational speed of the wheel), hydraulic modulator (the device that applies the brakes when necessary), and ECU (the control unit that takes information from the sensors and plans the best course of action). The addition of traction control to ABS involves adding another valve to the hydraulic

brake-modulator. As such, installing traction control on a vehicle that already has ABS is relatively simple.

Traction control uses individual wheel-speed sensors to measure differences in the rotational speed of each wheel. These sensors are located on each wheel. When the ECU senses that one wheel is spinning faster than the others (an indicator that the wheel is losing traction), it sends a message to the hydraulic brake-modulator (attached to the ECU) and automatically reduces the speed of that wheel which lessens the slip.

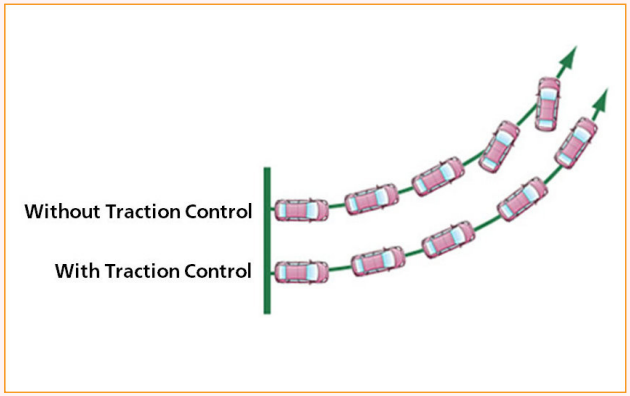


Image courtesy of Toyota Canada

Traction control systems have different ways of reducing the rotational speed of individual wheels. Some "pump" the brake to the problem wheel, while other systems combine wheel braking with reduced engine power. In a vehicle that uses reduced engine power to control the rotation of slipping wheels, the driver may experience a pulsation of the gas pedal when traction control is active. This sensation is similar to the experience of having the brake pedal pulsate when ABS is active. Once the wheels have regained traction, the traction control systems returns to monitoring wheel speed and comparing the rotational speed of the vehicle's wheels.

Is traction control effective?

Tests have shown that traction control is effective for reducing wheel slip when accelerating in low-friction conditions (Song and Boo 2000), although this effect is more noticeable in four-wheel drive vehicles than in front-wheel drive vehicles. In addition, the same study found that traction control systems that incorporate reductions in engine power to problematic wheels are associated with slightly better stability, but that brake-only traction control systems are suitable for improving the acceleration performance of a vehicle (Song and Boo 2000).

The effectiveness of traction control to reduce or prevent road injuries has not been well documented. Nonetheless, due to often being packaged together with ABS and ESC, it is reasonable to suggest that driving a vehicle equipped with this trio significantly reduces crash risk. To illustrate, ESC alone has been found to reduce the risk of single-vehicle fatal crashes by almost 50%, and to reduce the risk of rollovers by around 75% (Insurance Institute for Highway Safety (IIHS) 2010).

There may however be risks associated with having traction control due to the way drivers react to the safety system. For example, it has been argued that some of the conflicting data on the effectiveness of ABS is the result of how drivers act to both the sound of their ABS setups functioning and the regained steering control. First, drivers may be unsure about the sounds and sensations associated with the proper functioning of ABS, and this potential for confusion also has consequences for traction control. When it is working, traction control systems produce grinding sounds and the gas pedal may pulsate. If drivers are unfamiliar with how their traction control works, these could be mistaken for signs that traction control is defective in some way, and drivers may disengage it. Second, since traction control helps drivers to maintain steering power by preventing wheels from spinning, drivers must be careful not to exaggerate their steering commands in situations where traction control is working, since these exaggerated commands may make the vehicle more difficult to control.

Does traction control have any limitations?

Yes. Traction control works by preventing your tires from slipping, thereby allowing your wheels to take full advantage of the traction that is available on the road. Traction control cannot increase the total amount of traction available. To illustrate this point, if there is no traction on the road because the road is iced-over completely, then no one has traction. Traction control cannot create traction where it does not exist.

Drivers who choose to drive in slippery conditions face the challenge of reduced traction equally, whether or not they have traction control on their vehicle. The difference is that drivers with traction control are more likely to successfully accelerate in low-traction conditions since traction control prevents their wheels from spinning. In addition, since the vehicle's wheels are not spinning, drivers are able to maintain steering control. However, it cannot be overstated that drivers with traction control do not experience more traction; just better handling on whatever little traction is available. Therefore, drivers are encouraged to limit or avoid driving in slippery, low-friction conditions, whether or not they have traction control.

On a related note, while vehicles without traction control might experience a reduction in speed on slippery roads, the same speed reduction may not be observed in vehicles with traction control. As such, the traction control system may allow vehicles to reach a higher speed than is desirable for roadway conditions. You should always take care to monitor your speed and to ensure that it does not exceed what is safe for current conditions.

It is always important to stay vigilant and focused on your driving, no matter what safety features are on the vehicle. Behaviours like speeding, driving while distracted, and tailgating can have a significant effect on the performance of safety features including traction control. Traction control does not help you stop faster, so engaging in any behaviour that lengthens your reaction time will have an adverse effect for your overall safety. Reaction time is increased by driver distraction, driver fatigue, and alcohol-impairment.

Vehicle safety features are designed to help reduce your risk of involvement in a collision. If you choose to engage in dangerous driving behaviour, the risk of crashing increases. In addition, the effects of risky behaviour on the performance of your safety features are largely detrimental, as more pressure is put on safety features to work at the very limits of their capacity. When these limits are surpassed, your chance of being involved in a collision increases again. The end result is that driving dangerously with safety features may be riskier than driving safely.

Can I turn traction control off?

Yes, you can turn traction control off. Turning off this feature normally involves simply pressing a dashboard button/turning a switch to the OFF position, but can also involve manually pulling a fuse from within or outside the vehicle. Your owner's manual will explain how to disengage traction control.

There are situations where you might want to turn traction control off. For example, if you are already stuck in the snow, sometimes the only way to move forward is by "blasting out", i.e., pressing down heavily on the accelerator and letting your wheels spin in hopes that some traction will be regained. If traction control is active, the wheels will be prevented from spinning and it is likely that you will remain stuck.

If you do turn off traction control, remember to turn it back on as soon as the situation that led to it being disengaged is resolved.

How many vehicles today have traction control?

Traction control systems were first introduced on high-end vehicles in 1987, although some powerful rear-wheel drive vehicles in the early seventies were equipped with early versions of traction control systems.

In terms of availability, traction control is generally available on any vehicle that has ABS since traction

control was designed and built off of existing ABS technology. Both ABS and traction control have been around for a long time compared to other safety features, and are available on a range of vehicles in the high-end and economy markets. However, just because your vehicle has ABS does not automatically mean it has traction control. Some older vehicles may only be equipped with ABS. If you are unsure of whether or not your ABS-equipped vehicle also has traction control, you can consult your owner's manual.

How much does traction control cost?

Traction control is normally offered as part of a larger safety package, rather than as a stand-alone system. ABS, traction control, and ESC are usually packaged together in order to equip drivers with the most modern, complementary braking technologies. When traction control is offered as a stand-alone system, it can cost between $200.00 and $500.00.

References

Visit **www.brainonboard.ca/program_resources/references.php** for a full list of references.

Want to learn more?

Visit **www.brainonboard.ca** to learn more about vehicle safety features:

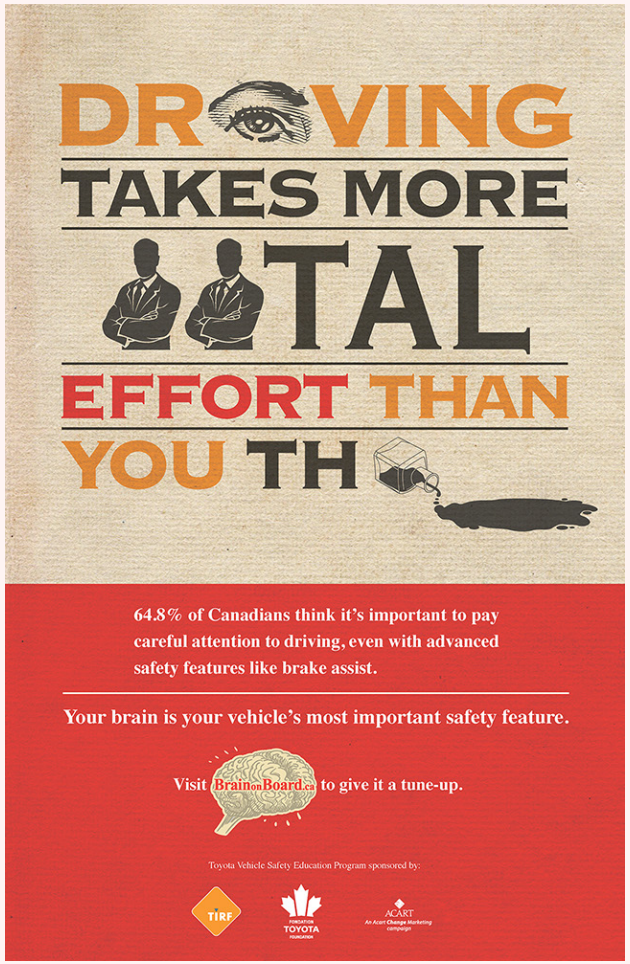
- Active Safety Features
- Passive Safety Features
- Driver Assistance Technologies
- Safety Technologies in Development

Driving instructors, road safety educators, car dealers and service providers can download and

BrainonBoard.ca

Your brain is your vehicle's most important safety feature.

order program resources and materials through the Brain on Board website. **www.brainonboard.ca/program_resources/**.



A TIRF education program

Program proudly supported by FONDATION TOYOTA FOUNDATION

BrainonBoard.ca