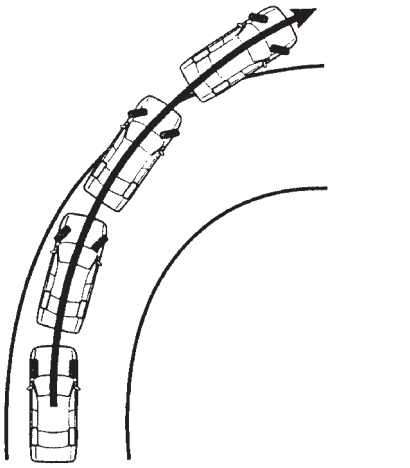
5. Outline of VSC System

General

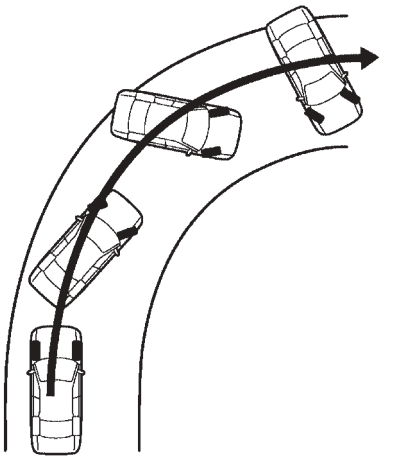
The followings are two examples that can be considered as circumstances in which the tires exceed their lateral grip limit.
The VSC system is designed to help control the vehicle behavior by controlling the engine output and the brakes at each wheel when the vehicle is under one of the conditions indicated below.

- When the front wheels lose grip in relation to the rear wheels (front wheel skid tendency).
- When the rear wheels lose grip in relation to the front wheels (rear wheel skid tendency).



151CH17

Front Wheel Skid Tendency



189CH100

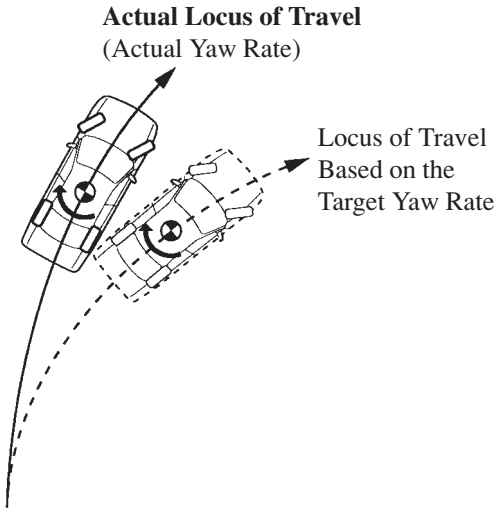
Rear Wheel Skid Tendency

Method for Determining the Vehicle Condition

To determine the condition of the vehicle, sensors detect the steering angle, vehicle speed, vehicle's yaw rate, and the vehicle's lateral acceleration, which are then calculated by the skid control ECU.

1) Determining Front Wheel Skid

Whether or not the vehicle is in the state of front wheel skid is determined by the difference between the target yaw rate and the vehicle's actual yaw rate.
When the vehicle's actual yaw rate is smaller than the yaw rate (a target yaw rate that is determined by the vehicle speed and steering angle) that should be rightfully generated when the driver operates the steering wheel, it means the vehicle is making a turn at a greater angle than the locus of travel.
Thus, the skid control ECU determines that there is a large tendency to front wheel skid.



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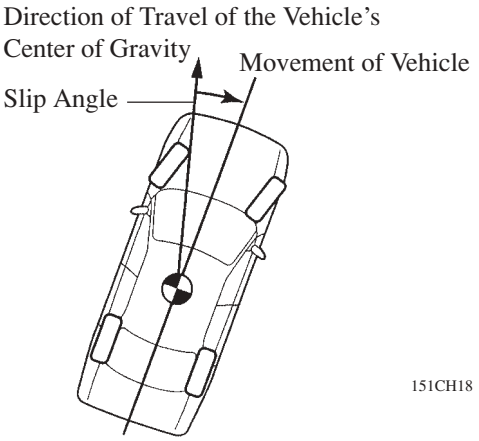
2) Determining Rear Wheel Skid

Whether or not the vehicle is in the state of rear wheel skid is determined by the values of the vehicle's slip angle and the vehicle's slip angular velocity (time-dependent changes in the vehicle's slip angle). When the vehicle's slip angle is large, and the slip angular velocity is also large, the skid control ECU determines that the vehicle has a large rear wheel skid tendency.

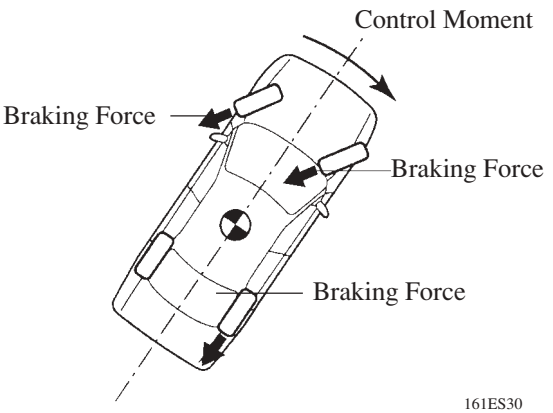


Method for VSC Operation

When the skid control ECU determines that the vehicle exhibits a tendency to front wheel skid or rear wheel skid, it decreases the engine output and applies the brake of a front or rear wheel to control the vehicle's yaw moment.
The basic operation of the VSC is described below. However, the control method differs depending on the vehicle's characteristics and driving conditions.

1) Dampening a Strong Front Wheel Skid

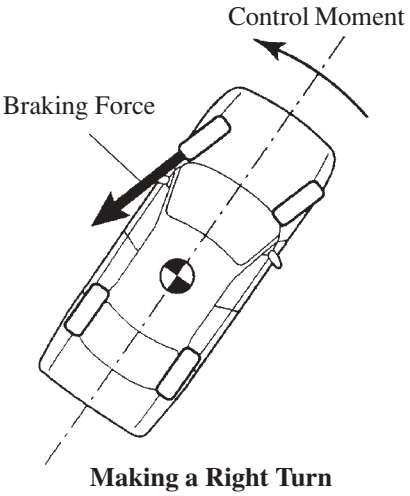
When the skid control ECU determines that there is a large front wheel skid tendency, it counteracts in accordance with the extent of that tendency. The skid control ECU controls the engine power output and applies the brakes of the front wheels and rear wheel of the inner circle of the turn in order to help restrain the front wheel skid tendency.



Making a Right Turn

2) Dampening a Strong Rear Wheel Skid

When the skid control ECU determines that there is a large rear wheel skid tendency, it counteracts in accordance with the extent of that tendency. It applies the brakes of the front wheel of the outer circle of the turn, and generates an outward moment of inertia in the vehicle, in order to help restrain the rear wheel skid tendency. Along with the reduction in the vehicle speed caused by the braking force, which helps dampen a strong rear wheel skid tendency.
In some cases, the skid control ECU applies the brake of the rear wheels, as necessary.



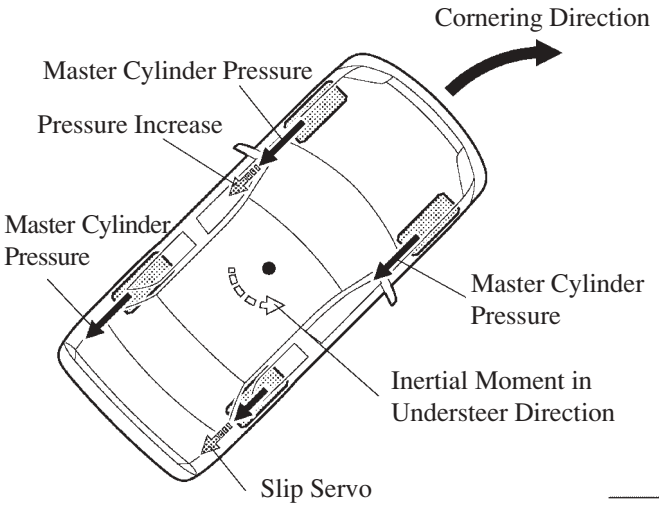
Making a Right Turn

Braking Control Under the Conditions in Which the Tires Do Not Exceed the Lateral Limitations of the Vehicle

1) During Cornering Braking

The VSC system determines the cornering conditions of the vehicle in accordance with the signals provided by the yaw rate & deceleration sensor, and the speed sensor. It determines the extent of the brake pedal application by the driver in accordance with the signals provided by the master cylinder pressure sensor.

When the vehicle is braking while cornering, the brake actuator increases the brake fluid pressure to the front outer wheel of the turn, and simultaneously controls the brake fluid pressure to the inner wheel of the turn. This generates a moment of inertia that inhibits the vehicle from veering further inward of the turn. As a result, this system provides the excellent vehicle stability and braking performance.



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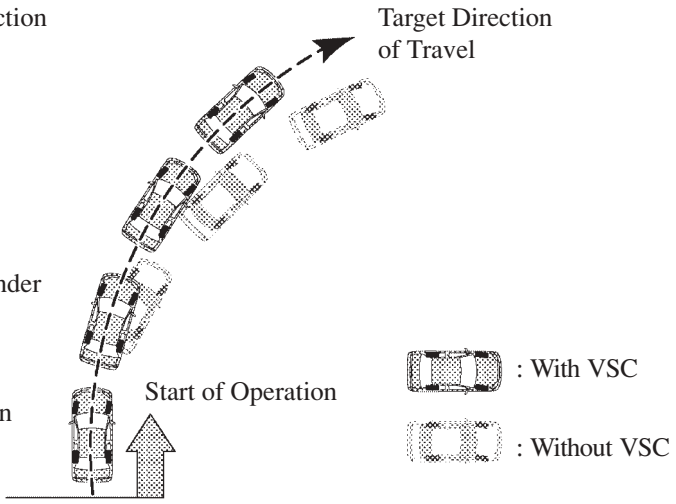

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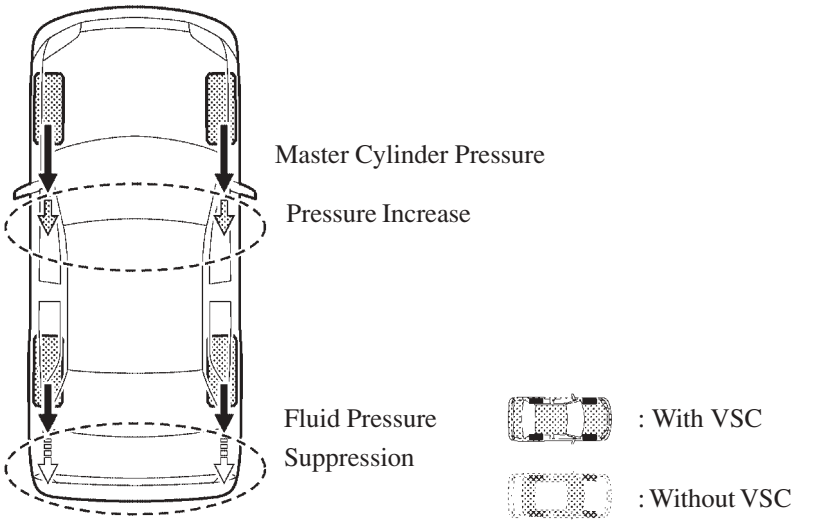
2) During High-Speed Straightline Braking

The VSC system determines the extent of the brake pedal application by the driver in accordance with the signals provided by the master cylinder pressure sensor, and the high-speed driving conditions in accordance with the signals provided by the speed sensor.
When the fluid pressure in the master cylinder reaches a predetermined value while the vehicle is braking at a predetermined speed or higher, the system controls the brake fluid pressure applied to the rear wheels as a result of the driver's further application of the brake pedal. This helps suppress the slippage of the rear tires and provides the excellent stability of the vehicle.
To compensate for the reduction in the braking force due to the suppression of the fluid pressure to the rear brakes, the brake actuator increases the fluid pressure to the front wheel brakes, in order to provide the proper braking force required by the driver.



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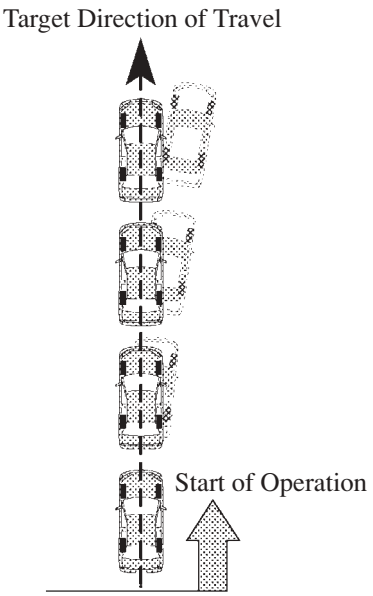

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