

# Effectiveness of Electronic Stability Control on Maintaining Yaw Stability When an SUV Has a Rear Tire Tread Separation

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## ABSTRACT

Electronic Stability Control (ESC) has the potential of improving yaw stability and reducing the occurrence of a crash when a vehicle experiences a rear tire tread separation. Two instrumented 4-door, RWD SUV's equipped with ESC were tested to evaluate the effectiveness of their ESC systems on maintaining yaw stability under these circumstances. The test vehicles were evaluated with the tread and outer steel belt removed from the right rear tire. Tests were run with the ESC engaged and then repeated with the ESC disengaged. All runs were completed with the tires inflated to the manufacturer's recommended pressure. An analysis of the data collected shows that there are significant differences in the steering input required to generate a loss of control response with and without ESC enabled. Results of Sine with Dwell testing demonstrate a significant reduction in vehicle spinout response with the ESC engaged. Over three times more steering input was required before the vehicle exhibited a spinout response with ESC enabled when compared to the ESC disabled vehicle. This will likely have a positive effect on a driver's ability to maintain control when faced with a rear tire tread separation under real world circumstances.

## INTRODUCTION

A rear tire tread separation event can lead to loss of vehicle control as a result of an unexpected deviation to the vehicle's intended path in combination with the significant change that occurs to the vehicle's understeer/oversteer characteristics (references 1, 2, and 3). Designers have had difficulty providing substantial improvements in the basic vehicle response and handling changes caused by a rear tire tread separation event. The National Highway Transportation Safety Administration (NHTSA) commissioned a study (reference 4) that found that increasing a vehicle's understeer coefficient will improve a driver's chances of maintaining control in the event of a rear tire tread separation. Continuing to increase a vehicle's understeer coefficient to eliminate loss of control events caused by tread separations ultimately comes at the expense of vehicle responsiveness. A vehicle that is too unresponsive will generate a whole new set of problems for a driver in other emergency situations.

ESC was designed to enhance yaw stability when a vehicle is experiencing an excess understeer (plow out) or oversteer (spinout) response (Figures 1 and 2) (reference 5) by managing the throttle and applying individual wheel brakes as necessary in an attempt to maintain the driver's intended path.

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