

# Issues & Trends

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## STABILITY CONTROL SYSTEMS FOR COMMERCIAL TRAILERS

For Fleets with an Immediate Need for Stability Control, Trailer-Based Systems Represent the Most Practicable Way to Protect Drivers, Cargo and Equipment

### Introduction

Only eight percent of Class-8 tractors in North America are equipped with technology that can reduce the likelihood of a rollover accident. This figure is bound to rise as more original equipment manufacturers make roll stability technology a standard feature or more attractive option.

But the lack of a practicable retrofit for tractors can frustrate owners who see an immediate need for stability controls in their operation.

For these fleets, the trailer presents their best, most cost-effective opportunity to apply stability technology to vehicles already in service.

This paper explores the features and benefits of trailer-based stability aids and examines the capabilities of Meritor enhancement system available to vehicle WABCO RSS*plus*<sup>TM</sup>, a trailer stability

manufacturers and the aftermarket starting in early 2008.

### How Stability Controls Work

Trailer-based stability control is managed by the electronic control unit (ECU) and incorporates the antilock braking system. This ECU contains an accelerometer that measures lateral or side-to-side movements of the vehicle. As the trailer rounds a curve or is involved in a sudden steering maneuver, the ECU is continually calculating the trailer's roll stability threshold based on lateral acceleration and individual wheel speeds. Before a rollover is imminent, the system will automatically apply the trailer-axle brakes slowing the vehicle to reduce lateral acceleration and restore control to the driver.

It does so with precision in a turn or steering maneuver: When lateral acceleration begins to push the vehicle horizontally and the load from the tires on

the inside of a turn shifts to the tires on the outside, and a calculated lateral acceleration threshold is being exceeded, the system will automatically deliver greater braking force to the individual wheels that bear the heavier loads to stabilize the vehicle. The ABS ensures that the wheels do not lock up.

This process occurs independently from the tractor, which may or may not have a stability system of its own. It also can happen without intervention from the driver. Drivers often have a difficult time sensing proximity to the road surface due to the isolating nature of the cab. By the time the driver recognizes an impending roll over, corrective action is too late (evasive maneuvers are taken in less than 10 percent of rollover crashes, suggesting that nine times out of ten, a rollover occurs before the driver can react.)<sup>1</sup>

Stability controls are most effective when speed and lateral acceleration are critical factors—in lane-change maneuvers and roads with sharp curves such as highway entrance and exit ramps. A disproportionate number (roughly seven percent) of commercial-vehicle rollover crashes occur on highway ramps; in most cases these are single-vehicle rollover crashes that involve the tractor trailer combination exceeding its rollover threshold and no collision with another object prior to the vehicle turning over.<sup>2</sup> Meritor WABCO trailer roll stability systems can significantly reduce the chances of this happening.

### Benefits of Trailer-based Systems

Reducing the human and property costs associated with rollovers is, without question, an important objective for fleets that specify stability controls. However, there are numerous other benefits:

- **Simple design.** Trailer stability controls use existing ABS wheel speed sensors

and incorporate a lateral accelerometer into the ECU. There is no additional hardware required as the roll stability function is basically a software solution. The system requires no more maintenance than ABS would require. Furthermore, the price may only be a few hundred dollars more than standard 2M (two-modulator) ABS.

- **Easy to retrofit.** Installation on an ABS-equipped trailer primarily involves replacing the ABS ECU and valve with the *RSSplus*. Existing brake sensors can be reused to decrease the installation expense. Retrofit kits are also available for non-ABS-equipped trailers.
- **Works with or without stability control systems on the tractor.** This is especially important to fleets that use brokers or owner-operators or have little influence over the specification of the tractors connected to their trailers. Stability controls on the trailer add value to the equipment and provide the fleet with some measure of protection regardless of the tractor spec.  
  
Equipping both the tractor and trailer with electronic stability control systems provides maximum directional control and rollover mitigation. Also, if there is a fault in the tractor system, the trailer system will still function.
- **Advanced ABS performance.** The standard ABS algorithm is based on wheel acceleration and deceleration. The added monitoring of lateral acceleration allows for a more sophisticated and accurate ABS algorithm, which can lead to even better ABS performance.

- **Driver control.** Stability controls cannot prevent all accidents resulting from loss

of directional control or exceeding a vehicle's rollover threshold. Stability controls provide important assistance to a driver in maintaining control of the tractor-trailer combination. Ultimately, an alert and unimpaired driver is primarily responsible for managing the vehicle's speed and direction given the load and road conditions at the time.

- **Reduced liability exposure.** Unlike other safety technologies, stability controls cannot be deactivated or ignored by the driver. This can help reduce the fleet's exposure to lawsuits related to traffic accidents and their related costs by reducing the likelihood of accidents.
- **Event data recording.** The ECU captures data about braking and stability events. This creates a record of accurate, detailed information that fleet managers can use to identify trends and build more effective driver training programs. If fleet managers can use information from the stability control system's onboard recorder to help drivers recognize unsafe behavior, they may generate returns on their investment that go beyond simply keeping the wheels on the ground in an emergency.

### **Advanced Features: Communications and Controls**

Meritor WABCO's *RSSplus* represents the next step in trailer ABS with stability controls. Available in Spring 2008, *RSSplus* is a 2M (two-modulator) stability system developed for North American trailers with spring or air suspensions. It succeeds Roll Stability Support (RSS), introduced to North America in 2003.

Besides reducing the potential for rollovers, *RSSplus* has the capacity to receive, process, and communicate a wide range of information.

The *RSSplus* ECU has generic input/outputs that can continuously monitor or control up to five functions, including wheel-end temperature, lining wear, push-rod stroke, hubodometer miles, air reservoir pressure, door-open sensors, and others. The ECU can convert SAE J1708/J1587 status messages (including roll-stability status) to Power Line Carrier (PLC) format, opening a line of communication with the tractor via the J560 connector.

Once the messages are translated back to J1587 dialogue and become available on the tractor's data bus, the information can be displayed in the tractor or can relay the information to fleet managers via telematics. Potential benefits of telematic communications:

- Correlation of stability events with precise time and location data, allowing fleet managers to identify specific trouble spots and emphasize the need for extra caution.
- With the *RSSplus* ECU as the trailer's nerve center, maintenance managers can remotely monitor the performance of critical trailer systems. They can schedule trailer maintenance on an exception-basis and provide information that will help the technician diagnose problems quickly and accurately. This can improve utilization rates and reduce shop-labor costs.

### **Regulatory Path for Stability Controls**

On September 1, 2011, the U.S. National Highway Traffic Safety Administration will require most new light vehicles (under 10,000 lbs) to be equipped with electronic stability controls (ESC). The agency calls stability control systems "the single most effective way of reducing the total number

of traffic deaths,” and the most cost-effective. It says ESC is particularly effective in single-vehicle crashes resulting in rollover, where ESC systems were estimated to prevent 71 percent of passenger car rollovers and 84 percent of SUV rollovers in single vehicle crashes.<sup>3</sup>

While NHTSA has no similar mandate for heavy trucks or trailers, studies are ongoing. Recognizing the benefits of these stability control systems, the U.S. Federal Motor Carrier Safety Administration has supported tax incentives as a way to promote voluntary adoption of safety technologies. European Union countries are preparing to make ESC mandatory by reference to UN/ECE braking Regulation 13. It would require new commercial vehicles to have electronic stability controls starting in 2010.

## Conclusion

Rollover accidents represent just three percent of all crashes that involve tractor-trailer combinations.<sup>4</sup> When they occur, the damage can be significant. According to the U.S. Department of Transportation, rollovers are a factor in 13 percent of all fatal crashes of combination vehicles. They account for 52 percent of all truck-occupant fatalities, and between 42 percent and 45 percent of injuries suffered in single-vehicle truck crashes.<sup>5</sup>

Stability controls for trailers are proven systems that can help a driver maintain control of the tractor-trailer combination and reduce the likelihood of a rollover. However, while stability controls for trailers are increasingly important in improving tractor-trailer stability, an alert and unimpaired driver following safe driving procedures remains the most important element in its safe operation.

- 1, 2. Cargo Tank Roll Stability Study. Prepared by Batelle for the U.S. Dept. of Transportation, Federal Motor Carrier Safety Administration (April 2007).
3. Final Rule, Federal Motor Vehicle Safety Standards; 49 CFR Parts 571 and 585, Electronic Stability Control Systems; Controls and Displays (April 2007).
4. Truck Rollover Characterization Project, National Transportation Research Center Inc. (July 2005).
5. John Hill, administrator, Federal Motor Carrier Safety Administration, remarks at Cargo Tank Rollover Summit Meeting, Baltimore, Md, Nov. 28, 2007.

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