ROAD MAP FOR THE FUTURE –

WHAT'S HAPPENED WITH STABILITY SINCE 2008?

Bendix Commercial Vehicle Systems LLC
901 Cleveland Street • Elyria, Ohio 44035
1-800-247-2725
www.bendix.com • www.knowledge-dock.com

It's hard to believe that it's been almost 10 years since Bendix initially authored its position paper on electronic stability control (ESC). The piece – entitled "Road Map for the Future: Making the Case for Full Stability" – presented the logic surrounding the arguments for full stability over roll-only stability. During the time since then, a lot has happened regarding stability control – most all of it positive. First and foremost is NHTSA's (National Highway Traffic Safety Administration) (the Agency) long anticipated Notice of Proposed Rulemaking (NPRM) in 2012, and then a final rule, in 2015, mandating stability on commercial vehicles.

Why did the Agency choose full stability over roll-only?

The answer is simple.

The research and testing conducted soundly resolved that full stability would help prevent more crashes, reduce more injuries, and save more lives than roll-only technology.

The good news is that the mandate takes effect beginning on August 1 of this year (2017), requiring full-stability control on Class 7 and 8 6x4 highway tractors. The decision, as advocated in our white paper, makes sense – ESC is a proven technology that does more than roll-only technology to help drivers mitigate rollovers and loss-of-control situations on dry, wet, and ice- and snow-covered roadways. Implementation of the mandate is over three years, with Class 8 motorcoaches requiring stability on June 24, 2018; Class 7 motorcoaches, and most of the rest of Class 7 and 8 tractors (6x2, 4x2, etc.), will require the technology by August 1, 2019.

Why did the Agency choose full stability over roll-only? The answer is simple. The research and testing conducted soundly resolved that full stability would help prevent more crashes, reduce more injuries, and save more lives than roll-only technology. We agreed then and we agree today. The 2008 Bendix paper presented our analysis (based on the Federal Motor Carrier Safety Administration's *Large Truck Crash Causation Study*) supporting the technology, concluding that in the 130 cases studied where stability control could have helped mitigate the situation, 68 percent could have mitigated the crash versus only about 29 percent for roll stability. Why? Because in a number of these situations, loss-of-control was a factor. And, as the white paper points out, ESC technology does a much better job of helping to mitigate these situations than roll-only stability. Also, ESC is a better rollover technology: It reads the situation sooner (thanks to the steer angle sensor) and is able to react earlier. ESC delivers more braking power to help mitigate rollovers. Despite some differing opinions on the

numbers from NHTSA – Bendix's perspective was that, in their study, the Agency overestimated the effectiveness of roll-only and underestimated the effectiveness of ESC – we contend that NHTSA made the right call in its mandate decision.

A Launching Point with Opportunities to Improve

While it addresses a significant heavy vehicle population, the mandate, in our view, has a drawback in that it leaves a sizable gap between Class 2 and Class 7 – the population of medium-duty trucks. The Agency, however, cannot be blamed for this missing piece.

First, even though full stability is available on Class 7 air-braked trucks, there is an absence on hydraulic vehicles – no system is readily available. Looking forward, we anticipate this will likely change, however, due to the population of Class 7 motorcoaches, some of which are hydraulically braked. This requirement for stability on hydraulically braked buses may open up the availability of full-stability control on medium-duty vehicles beyond those equipped with air brakes, closing the gap and enabling these trucks to benefit from the technology.

While it addresses a significant heavy vehicle population, the mandate, in our view, has a drawback in that it leaves a sizable gap between Class 2 and Class 7 – the population of medium-duty trucks. The Agency, however, cannot be blamed for this missing piece.

A second challenge – a byproduct from the mandate – is that it also omitted Class 7 and 8 single-unit trucks. These are all primarily air-braked vehicles. In some key applications, such as cement mixers and overhead bucket trucks, stability – which was ready at the time – can be quite beneficial for the vocational use. The expectation is that this exclusion, as well as one for hydraulic vehicles, will be addressed if the Agency moves forward with a collision mitigation mandate in the future. That future date, however, remains unclear and will likely require a change in administration, as it's doubtful we'll see much additional regulation forthcoming anytime soon.

And, finally, school buses were not represented as a vehicle class covered under the initial final rule. This is most disappointing because school buses do lose control, and stability can help mitigate that loss-of-control and eventual tip-over that occurs when the bus hits a curb or guardrail. While school buses are still one of the safest modes of transportation, when they

crash it is heart-wrenching. Uncertainty shrouds their inclusion in future mandates, but it's gratifying to know that some bus OEs are starting to make the technology readily available.

Driver Assistance Systems – Evolving to Address More Issues

Since the initial publication of our white paper, another big change is the introduction and advancement of collision mitigation technologies, like the Bendix® Wingman® family of solutions. In 2009, Bendix introduced Wingman® ACB – Active Cruise with Braking, our adaptive cruise control technology designed to help trucks maintain a safe following distance behind a forward vehicle. This was a significant departure from prior product generations as we added braking, not just dethrottling, to help the driver maintain the following distance.

ACB brought about Bendix® Wingman® Advanced™ – A Collision Mitigation Technology, where we added collision mitigation braking along with adaptive cruise control. Wingman Advanced gave rise to Bendix® Wingman® Fusion™ – utilizing camera, along with radar, to integrate functions and deliver even higher levels of collision mitigation braking. Why care about collision mitigation when we're talking about stability technology? Because collision mitigation technology is built on a foundation of full stability. And, as we look to more automated, autonomous functionality in the future, all of this will be built on a full-stability foundation as well.

Since the initial publication of our white paper, another big change is the introduction and advancement of collision mitigation technologies, like the Bendix® Wingman® family of solutions.

When our paper was released, automated/autonomous vehicles were still the fodder of fantasy and "some day" for most participants in the commercial vehicle marketplace. For context, in its "Federal Automated Vehicles Policy" released in November 2016, NHTSA defined five levels of automation, based on the SAE (Society of Automotive Engineers) J3016 "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems." You can read more about this policy and the scope of the levels in the blog entitled "Why Five?" on the Bendix multimedia center, www.knowledge-dock.com.

Today, depending on who you talk to, automated/autonomous vehicles could be here in short order. Well, at least to automation Level 3 (where the automated system conducts some part

of the driving task *and* monitors environment in some instances; a human driver must take back control when the system requests). While the availability debate rages, one point remains reasonably clear – the vast majority agrees that automation Level 5 (no driver – the automated system performs all driving tasks, under all conditions, that a human driver can perform) is a long way off.

It is our belief that the stability foundation of today will, for the most part, be a foundational element of automated and autonomous tractor-trailers, trucks, and buses in the future, just as it is a part of automated/autonomous cars and light trucks. Even computer-driven trucks can lose control, or find themselves in situations that could lead to a rollover, so stability will be a part of the technology moving forward.

Has Stability Made an Impact?

The passage of time since the release of the Bendix paper also begs the question: What's been happening with stability-related crashes in light of the increasing availability of stability technology? Looking back to 2008, when the white paper was published, according to the 2008 *Large Truck and Bus Crash Facts* from the Federal Motor Carrier Safety Administration (FMCSA), there were 11,283 large trucks involved in rollovers, and 5,190 large trucks involved in jackknifes. Conversely, in 2015, according to the early release version of the *Large Truck and Bus Crash Facts*, 9,272 trucks were involved in rollovers and 4,226 in jackknifes. Initial conclusions point to a bit of a decline; however, further evaluation is necessary pending release of the final 2015 report.

It is our belief that the stability foundation of today will, for the most part, be a foundational element of automated and autonomous tractor-trailers, trucks, and buses in the future, just as it is a part of automated/autonomous cars and light trucks.

Delving a bit deeper into the numbers is in order. This time, however, it's appropriate to examine the 2008 data compared with 2014 data from the *Large Truck and Bus Crash Facts*. Why go back a year? Since the 2015 report is an "early release" version, there are no statistics on the number of registered large trucks or millions of miles traveled by large trucks. To compare properly, it's imperative to take a step back. The 2008 information noted above doesn't change, but, for 2014, there were 10,259 large trucks involved in rollovers

and, surprisingly, 7,193 large trucks involved in jackknifes. While the increase in the number of jackknifes is notable, it may be tied to a particularly bad streak of weather in some part of the country that skewed the results a bit.

Some element of "normalcy" seems to return in 2015, at least as evidenced in the early report. This presumption is supported by the report statistics: More crashes involving heavy trucks occurred on snow-, ice-/frost-, or slush-covered roadways in 2014 than in 2015 (over 5,000 more large truck crashes in 2014 than 2015 in these conditions). Looking at a per-million-mile rate of rollover and jackknife incidents in the comparison years of 2008 and 2014, we find the following:

	Large trucks in rollovers per million vehicle miles traveled	Large trucks in jackknife crashes per million vehicle miles traveled
2008	.363	.0167
2014	.368	.0258
2015	2015 large trucks in jackknife crashes per 2014 million vehicle miles traveled = .0151 (Because 2014 appears to be an abnormality, a comparison of 2015 numbers with 2014 miles for jackknifes might be helpful.)	

What this concludes is that, in general, there has been little change in the rate of rollovers and jackknifes for heavy trucks. While this is disappointing, one needs to consider the penetration rate for stability systems in what is generally considered the large truck categories – Class 3-8 vehicles. Taking our estimated market number of stability systems sold through 2014 – roughly about 850,000 units, of which 1/3 (280,500), presumably, are roll-only stability systems, and 2/3 (569,500) are full-stability systems – it's clear that penetration in the fleet is relatively low, with only about 8 percent of the large trucks registered in 2015 having a stability-control system. (And, as we've discussed in the paper, roll-only stability does nothing to support loss-of-control situations – only about 5 percent of these vehicles had full stability.) Keep in mind, as well, that 78 percent of the large trucks involved in crashes were Class 7 or 8.

The bottom line is the penetration of stability needs to increase to help reduce the overall numbers of rollover and jackknife crashes. The mandate is a start to help make this happen.

We're happy to report, however, that penetration does continue to increase. Bendix has seen the take rates on full stability steadily increase every year since its introduction. All Class 6, 7, and 8 air-braked commercial vehicle OEs offer full stability, and an increasing number are making stability standard on their highway tractors. Also, all are offering it across an increasing array of vehicle types – including medium- and heavy-duty trucks. Plus, with the mandate, the proliferation of full-stability availability will, undoubtedly, increase.

Where Do We Go from Here – At Least as Far as an Update to the Bendix White Paper?
2017 will bring a deeper dive into the information above, especially with regard to the crash statistics. And, we'll take a look at a number of areas around automated/autonomous vehicle developments and how stability will play a role – as noted, now and into the far future. Finally, we'll revisit our cost and benefit models, both from the perspective of return on investment for fleets and from societal safety benefits.

And, where do we go with stability? Quite frankly, we believe in the technology and Bendix will continue to advocate the value of full stability until every Class 6, 7, and 8 air-braked vehicle built is equipped with stability. Because, as the stats show, there is still work to be done!

Look for our update this summer prior to the first phase of the mandate. In the interim, visit our multimedia center at knowledge-dock.com for updates and commentary on issues of note in the commercial vehicle industry. Feel free to share your comments and insights on this and other pressing questions about related issues at FSE@bendix.com. We welcome your feedback.

ABOUT THE AUTHOR

Fred Andersky, director of customer solutions – Controls, and director of government & industry affairs at Bendix Commercial Vehicle Systems LLC, is a marketing professional who has spent countless hours in discussions about active safety technologies with commercial vehicle fleets and owner-operators throughout North America. Possessing a CDL in Ohio, Andersky spearheads a variety of demonstration events across the country, enabling commercial vehicle industry participants to witness, firsthand, the benefits of advanced safety technologies. During his tenure with Bendix, Andersky has become a strong advocate for active safety technologies that are designed to advance commercial vehicle safety. He has presented to, and worked alongside, a variety of industry, regulatory, and legislative groups regarding the importance of active safety technologies for commercial vehicles.

Bendix Commercial Vehicle Systems LLC
901 Cleveland Street • Elyria, Ohio 44035
1-800-247-2725
www.bendix.com • www.knowledge-dock.com