ALRTA
Australian Livestock and Rural Transporters Association

*Guide*

# Braking Habits

Guide to making 'smart' brake systems work for transport operators, professional drivers and in the workshop

**The Australian Livestock and Rural Transporters Association would like to thank everyone who contributed to this project, it takes a community to drive industry safety.**

In particular, we would like to thank:

- Our two case study businesses, Betts Transport and Frasers Livestock Transport, for providing fantastic access to the leadership teams, drivers and workshops.
- Air Brake Systems for their generous support across nearly every facet of the project. The ABS team was tremendously generous with their contributions of brake system knowledge and troubleshooting
- The National Heavy Vehicle Regulator and the Commonwealth Government, without their support via the Heavy Vehicle Safety Initiative, this project would not have been possible
- The National Truck Accident Research Centre for its data insights and technical support across the project
- The National Road Safety Partnership Project for their graphic design, communications and marketing contributions

Finally, we would like to thank our member associations, their members and the entire Australian livestock and rural transport industry for their support, passion and work ethic.



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ALRTA

# Introduction

**As the peak body for livestock and rural transport associations, the ALRTA has often found itself at the forefront of discussion on heavy vehicle braking technology.**

Following industry concerns about in-service reliability and suitability for the operating environment, the ALRTA successfully lobbied in the 2010s for an exemption for livestock operators from the mandate of ABS.

With the industry-wide mandate of a 'Roll Stability Function' on new heavy trucks, prime movers and trailers, the ALRTA recognised that its members would benefit from support in getting value for money and maximising safety benefits.

To support this, the ALRTA applied for and received a Heavy Vehicle Safety Initiative (HVSI) grant. This grant scheme is funded by the Commonwealth Government and administered by the National Heavy Vehicle Regulator.

This guide forms part of a package of resources and is intended to support livestock (and other) operators on their journey into the world of smart braking.

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# Tall and Mobile

## The Livestock Stability Challenge

As a freight task, livestock transport contains a number of challenging elements:

- Livestock trailers are allowed to operate at up to 4.6m in height, allowing two decks of cattle, three decks of pigs and four decks of sheep. This results in vehicles with a higher centre of gravity than most other road transport tasks
- The livestock transport task largely occurs in remote and regional areas, with challenging terrain and varying road conditions
- The live cargo on board can only be contained, not fully restrained, which results in a dynamic load, with the vehicle's centre of gravity able to shift.

As a result of these challenging conditions, livestock transport is understood to be one of the more challenging occupations within the transport industry.

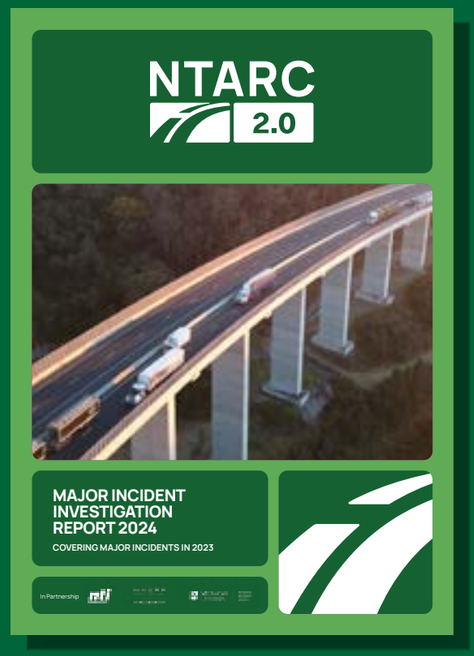
In turn, livestock transport is a specialist activity. There is limited mobility of businesses and personnel into livestock transport when compared to say general freight or bulk commodities.

Even before considering the challenges during driving operations discussed above, drivers first need to be experts in animal welfare and handling. As a result, most livestock drivers are specialists.

## Reflected in incident data

The National Truck Accident Research Centre (NTARC) is a partnership between Australia's specialist transport insurer, NTI, the National Road Safety Partnership Program (NRSPP) and the Monash University Accident Research Centre. The ALRTA consulted the NTARC for the insights into livestock crashes and the potential value of smart braking technologies.

## NTARC Livestock Insights




**The NTARC Major Incident Investigation Report Research Centre. The ALRTA consulted the NTARC for the insights into series explores incident data from NTI on truck crashes with an incident cost of $50,000 or more.**

The 2023 report identified that human factor related incidents were driving an increase in overall (e.g. all freight types) heavy vehicle incident frequency.

Looking specifically at livestock transport, human factors incidents represented 67% of losses. As proportions of all livestock losses, the leading causes of loss were:

- **Inattention/Distraction – 26%**
- **Inappropriate Speed – 17%**
- **Non-impact Fire – 17%**
- **Fatigue – 15%**

It is the inappropriate speed incidents which appear to be most likely to be influenced by smart braking technologies. Every inappropriate speed incident was coded as a 'Off path on curve' and 'Rollover' crash.

This incident mechanism is known in the road safety space as a 'Single Vehicle Untripped Roll Over' (SVURO).

This occurs when the vehicle's speed and dynamics are incompatible with the geometry of the road. Due to the high centre of gravity and narrow width of heavy vehicles, instead of sliding, the inside of the vehicle lifts off the ground and a rollover occurs.

# Smart Braking 101

## What are the technologies?

A number of functions/technologies are grouped together under the broad umbrella of 'smart brakes'. They are generally referred to by their acronyms which may result in confusion as to what acronym performs what functions. This section will outline the key functions and benefits of each technology.



## ABS - Anti Lock Braking System

### What

ABS reduces or eliminates wheel lock-up under braking.

### How

Utilising wheel speed sensors fitted to some wheel-ends within each axle group, ABS can detect when a wheel, axle or group of axles has stopped rotating while others continue to rotate, indicating brake lock-up.

It then utilises electrically-actuated pneumatic valves to reduce braking effort within the affected wheels, axles or axle group, allowing the locked wheel ends to resume rotating.

### Why

A tyre that is locked and sliding does not provide as much braking force, nor does it provide any directional control. By reducing or eliminating lock-up, ABS can provide improved directional stability under braking, avoid flat-spotting tyres and reduce the stopping distance under hard braking.

## EBS - Electronic Braking System

### What

EBS makes pneumatic brake systems respond faster.

### How

By adding an electronic brake signal which augments the pneumatic signal that transmits the 'request' for braking from the driver's input at the brake pedal to the brake valves near each axle group.

### Why

By reducing the lag in a pneumatic brake system, the system can begin to operate more quickly.

Additionally, all brake valves can respond near-simultaneously, providing a more stable braking application.

Because EBS systems have greater control over braking, they can also enable additional features such as stability control and electronic load sensing and proportioning.

Note: Where fitted to a trailer, EBS may also be referred to as Trailer Electronic Braking System (TEBS).

## ESC - Electronic Stability Control

### What

Detect and respond to potential roll-over events

### How

Building on the capability of EBS, ESC combines inputs from wheel speed, airbag pressure and steering angle sensors (where fitted) and accelerometers to detect high g-force and wheel-lift events.

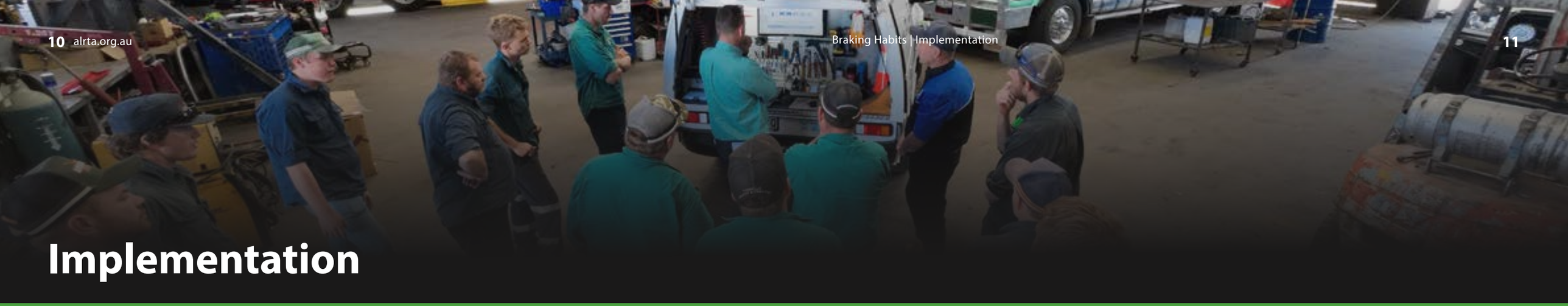
It can then respond by applying brakes on individual wheel to remove energy from the system and seek to stabilise the combination and mitigate the risk of a rollover.

### Why

A rollover crash is a catastrophic and high-consequence event. It has high potential for loss of life and a near guarantee of severe property damage.

Data provided by the NTARC suggests that between 1 in 40 and 1 in 50 truck roll-over crashes results in loss of life for the driver.

Note: ESC may also be referred to as Trailer Stability Control (TSC), Roll Stability Control (RSC) or a Roll Stability Function (RSF)



# Implementation

## Start and end with your people

Implementing new systems and technology into a business is always a complicated process and the introduction of smart braking technology in transport will be no different. However, by taking a structured approach you can reduce the workload and maximise the positive benefits.

While getting the equipment and tools right is important, arguably the most important element and one which is often overlooked, is ensuring you take your people on the journey.

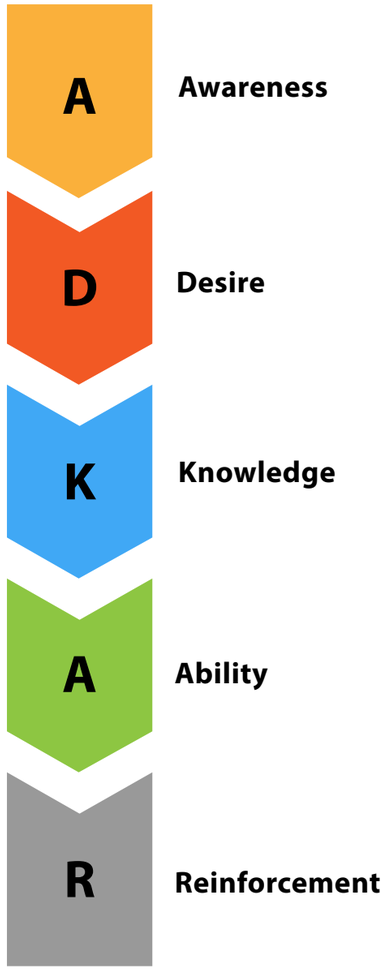
This doesn't need to be fancy or complicated, the key is to be open, authentic and to make sure your people feel heard.

## Communicate Early

Get on the front foot, let the team across your business know that smart braking technology is coming, what it is and what it might mean in their role.

Ensure you make the case for change, outline the reason for the change and the potential benefits. It's also important to be honest about the challenges and unknowns, your staff are more likely to pass on issues if you've flagged to them that issues are expected and that resources are available to try to resolve them.

A good model to align to is Prosci's ADKAR change methodology (although many others exist). It identifies five key steps in successfully managing change:




## Resistance to change

There are some topics that are likely to arise during the implementation of smart braking systems in a transport business. The first group of topics are predominantly human related. It can't be emphasised enough that it is entirely reasonable for people to express these concerns and this needs to be reflected in your response.

### "I don't like how it drives"

You may have drivers who express that the brakes in their combination respond or 'feel' different when the EBS system is functioning.

The first thing to do is to validate their concerns, particularly because in the livestock space, touchy brakes can have a real impact on animal welfare.

Ask the driver to demonstrate the difference, you can easily do A/B testing by repeating the same test loop with the EBS plugged-in and unplugged.

If the difference is minor, it may be worth asking the driver to trial for a period (e.g. two weeks) and report back. If the difference is significant, then you need to escalate to the brake system designer/certifier, this will usually require working through your trailer builder, as they will have the relationship with the vendor.

If you are not satisfied with the response or resolution, this could be a very good issue to raise with your local state livestock and rural transport association.

### "I don't like being watched"

This concern is entirely valid and may reflect past shortcoming in how employers and employees communicate (or fail to) in many transport businesses.

Have an open and honest discussion with the staff member about their concerns and discuss how they conflict with and/or align to how your organisation plans to use the system.

### "I don't want to be stranded"

Some drivers may be concerned that a system failure could leave them stranded. This is likely motivated by their high level of concern about animal welfare and as a result, may reflect positively on their cultural fit for livestock transport.

Highlight to them that smart braking systems are added on top of a traditional 'dumb' pneumatic braking system, so if the system fails, it fails back to being the exact system the industry has been running for decades.

## Technical Challenges

In addition to human concerns about the change, there are also some technical issues which may need consideration as you roll out smart brakes.

### 12v vs 24v

There has long been a battle around system voltage in heavy trucking, with European, military and some off-highway environments preferring 24 volts, while most North American trucks have been fitted with 12-volt systems.

Despite very high levels of familiarity with 12-volt systems in livestock transport workshops, the simple reality is that the need for a reliable power supply, particularly on longer combinations, makes 24-volt systems superior.

Due to this, when a Roll Stability Function (AKA ESC) was mandated under ADR 38, they also mandated that it be a 24-volt system for all units in a road train.

The practical result of this is that 24-volt EBS systems are the norm and where your prime movers are 12 volts, you will need to fit additional components to provide 24-volt power to your EBS trailers.

It may be worth discussing with your workshop, fleet manager and preferred truck manufacturer whether you should make the shift to purchasing natively 24-volt prime movers moving forward.

### Integrating with older equipment

How new EBS-equipped trailers are integrated into combinations with existing equipment may also be an issue. You simply don't get the benefit of the money spent buying EBS-equipped trailers if they're not powered up.

For your existing trailers, this can be resolved in one of two ways. As a lower-cost, but lower-value option, you can fit 'pass-through' power cabling that allows trailers rearwards in the combination to be powered-up.

The higher-cost, higher-reward option to progressively retrofit smart brakes to your existing trailers, perhaps when they come in for a major service or periodic 'birthday'. Discuss this with your preferred brake system vendor, the costs are likely lower than you expect.

For prime movers there are systems available which convert the 'dumb' pneumatic brake signal to a 'smart' brake request and provide power to the trailers. Again, discuss with your preferred brake system vendor for more information.



## Know what you've got

Before you think about new equipment, it is worth taking stock of what you've currently got. It is not uncommon to discover equipment in a fleet is already fitted with EBS. Beyond that, it is worth tracking which of your prime movers have EBS power sockets.

In checking your trailers, there are two relatively easy items to look for to identify that they may be fitted with EBS. Firstly, the presence of an EBS connection socket. Secondly, they should also be fitted with an EBS data plate.

EBS Sockets from a trailer (left) and prime mover (right)


EBS data plate as fitted to a trailer

**Once you've got a sense of what equipment you may already have, it's worthwhile to determine what you want to achieve.**
**Here are some questions to guide you:**

- What does success look like?
- Are you happy to introduce EBS as you turn over equipment or do you want to retrofit?
- What amount of EBS servicing do you want to be able to do in-house?
- Can any of your existing vendors (e.g. telematics) integrate EBS data into your existing systems?
- If you have existing trailers with EBS, you can organise a data download to see how frequently stability events are occurring, are you happy with that number?

## Specifying new equipment

Making the right decisions when purchasing new equipment can greatly influence the return on investment you get from the smart braking systems.

### Know your brake system vendor

When specifying a new trailer, talk with the manufacturer around which brands of brake system they offer. If you undertake servicing operations in-house, then confirm with your workshop team that they can support whatever system you're about to buy.

If you outsource 100% of your maintenance, then talk with your service providers around their preferences. Either way, it is likely that having fewer different brands will simplify your future maintenance.

### Get the details right

There are some small details which can make a big difference to the reliability of your system once it is in service:

- Require the use of O-ring sealed crimp-type EBS sockets, do not accept screw clamp connections

O-ring sealed EBS socket crimp terminals

- Specify that all wiring must be abrasion protected, either via grommets or appropriate conduit
- Consider requiring pre-terminated cables, this reduces the reliance on the auto-electrical skills of your trailer builder
- Ensure EBS sockets are mounted horizontally or downwards at up to 35 degrees down to avoid filling with debris and to reduce water ingress. With upward connectors and unsealed terminals, water can travel along inside the multi-cored wire and into other components

Downward-facing trailer connections to reduce debris build-up

- Ensure EBS valves are as protected as practical and that their mounting complies with brake system manufacturer specifications. Some brake systems vent against their mounting face and this surface must not have any holes which can allow ingress of debris.

## End-of-line

Include in the purchase agreement that at delivery, that the trailer must have completed an end-of-line test completed and have the test report printed and included with the documentation at hand-over.

This should ensure that the system is functional, however it is important to verify this through a thorough commissioning process.

## Commissioning new equipment

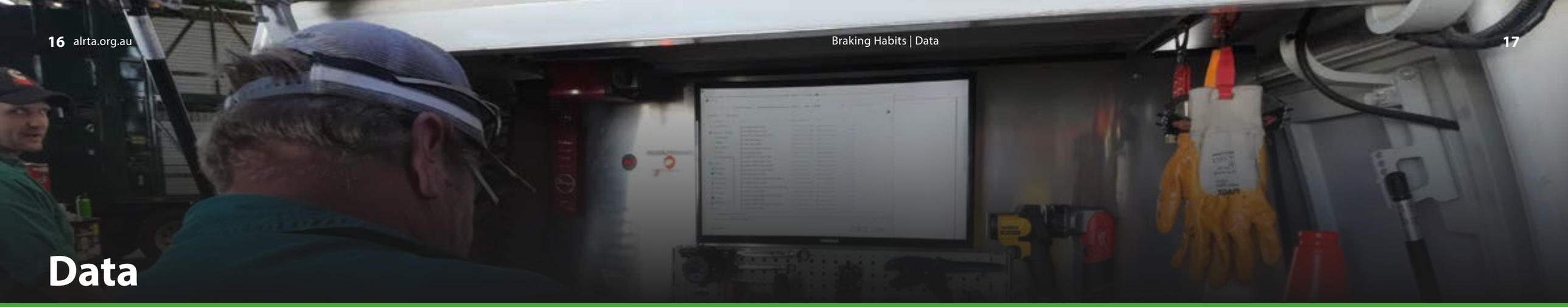
Purchasing new trailers is a big capital investment and confirming that you've received what you ordered - and that it is fully-functional - sets you up to maximise the return on that investment.

### Pre-commission

- Compile your records on what items were specified in the original design
- Determine what evidence you want to generate in case of future dispute, a dozen photos taken at commissioning may be very valuable in case of a dispute later.

### Example EBS checklist

- ☐ Confirm that the EBS data label is fitted and that the VIN, brake chamber size and slack adjuster length all match to the trailer
- ☐ EBS socket is between horizontal and 35 degrees downwards (including rear connection where applicable)
- ☐ EBS socket(s) features O-ring sealed crimp terminals
- ☐ Wiring to EBS socket(s) matches correct colour code
- ☐ Wiring between EBS socket and brake modules is appropriately supported, protected from abrasion and impact
- ☐ Brake module is securely mounted in protected location with shielding from incidental splash from washdown operations
- ☐ Wheel speed sensor wiring is routed to minimise risk of damage and is well-secured
- ☐ EBS socket tester (if available) shows correct operation
- ☐ When connected to prime mover, the trailer EBS dashboard light illuminates when the ignition is turned on, then goes out after 3-5 seconds.
- ☐ EBS software (if available) connects and status reports show no active faults



# Data

## Forewarned is forearmed

Smart braking systems don't just protect our people, cargo and the general public, they also create data which if used wisely can help support our drivers.

Drivers have long been told that they need to ensure that their speed is appropriate for a given corner, their vehicle and load. However other than it being apparent after a rollover that the speed was too high, there hasn't been many ways for individual drivers to know how much of a margin for error they had up their sleeve.

While smart braking systems can provide valuable data, it is important that it is used with care and consideration.

***"We need to use this data to celebrate the excellence of our best drivers"***

The risk here is that this either becomes or is perceived- as just another way that drivers are being judged or even punished by people who do not understand the challenges of the driving task.

Instead, the objective should be to publicly celebrate the high-performers and to position having good data as a demonstration of mastery. To do this, there are a few key steps, and the first is to understand the data that exists.

There are numerous types of data available from smart braking systems, however in terms of driver feedback, we can focus on two. Data on how the driver is using the brakes and data on how frequently the ESC is being triggered.

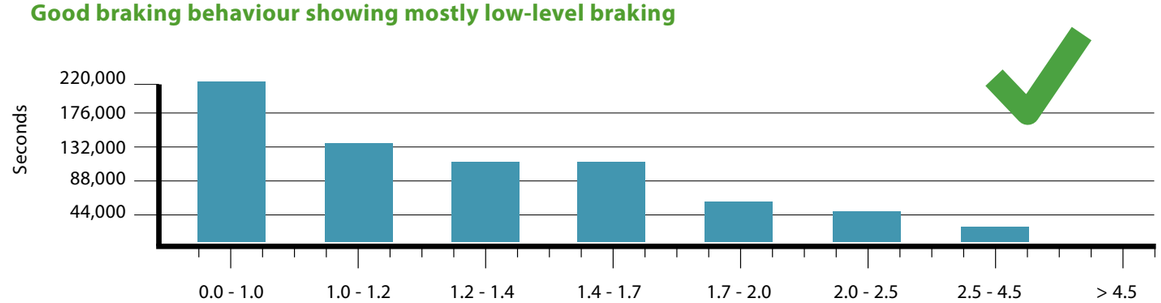
## Brake utilisation data

Contained within the log files of smart braking systems is data that can provide insights into how the brakes are being applied.

These systems contain a lot of data, but one which can provide great insight into driver behaviour and risk level is how long (in seconds) the brakes have been applied at different pressure levels.

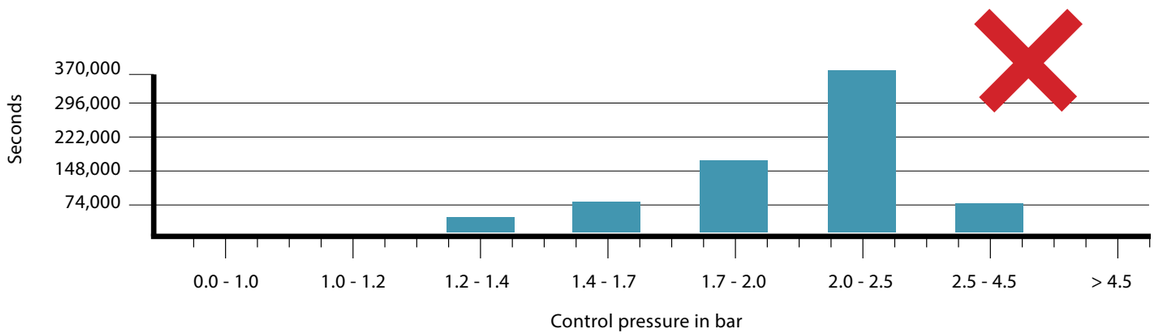
A driver who is maintaining a safe following distance, anticipating what is going to happen in traffic and primarily able to rely on their auxiliary braking sytems (Jake, retarder etc.) will spend more time at low brake pressures and less at high braking levels.

### Good braking behaviour showing mostly low-level braking




By contrast, a driver who is always driving aggressively, reacting at the last moment and relying heavily on hard applications of the service brakes will have the opposite in their brake utilisation data. With limited use of light applications of the brake and consistent high-force braking.

### Poor braking behaviour showing mostly high-level braking




Celebrating your best drivers through this data can have a number of benefits including, reduced brake maintenance costs, lower crash frequency, reduced driver stress and reduced risk of reputational harm from your drivers being seen behaving poorly on road.

## Electronic stability control data

Arguably the most powerful data for managing the risk of rollover crashes in the livestock transport industry is the record of interventions by a smart braking system's electronic stability control.

Different brands and systems may structure their data in different ways, so the first thing to do is communicate with your brake system vendor to understand what you're seeing.

In the case of the WABCO system used in this project's case studies, there are two levels of ESC interventions.

- A Level 1 intervention represents a high lateral (sideways) g-force event and the system responds with an extremely light application of the brakes to take up any free-play in the system and create light drag.
- A level 2 intervention occurs when the system detects the inside wheels lifting off the ground, indicating a roll-over is imminent. The system responds by applying the brakes, particularly on the laden side (towards the outside of the corner) of the vehicle, removing energy from the system and reducing the likelihood of a rollover.

All events are logged into the system and can be extracted. Below is a table summarising the real-world ESC data from two identical dog trailers operating in truck and dog combinations. Both operating in 'one driver – one truck' environments.

The first trailer is experiencing a level one intervention, on average, every 3000km and has never experienced a level two event. By contrast, the second trailer is travelling an average of 100km between level one events and is having 'wheels off the ground' moments about every 1000km.

Within a month of this data having been extracted from these trailers (December 2019) and before it had been acted upon by management, 'Combination B' was involved in a high-speed, single-vehicle crash and was damaged beyond repair.

Getting this information to our drivers and to other frontline personnel has a potentially large impact on safety, however care needs to be taken in how it is delivered, see the coaching section for more information.

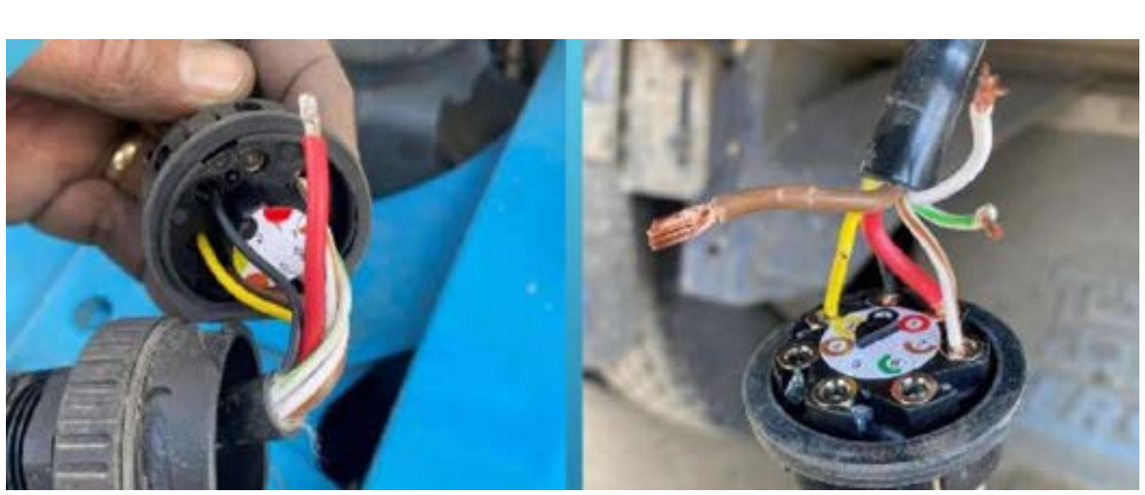
| Combination | Distance Travelled | Level One Interventions | Level Two Interventions |
|---|---|---|---|
| A | 46369 | 15 | 0 |
| B | 65180 | 674 | 69 |

## Brake system status data

Another key type of information contained within smart brake system logs is that around the system's own status.

This can be exceptionally useful in the workshop environment. With appropriate software, the EBS system guides a workshop technician to rapidly identify any faults and their location.

The system also logs intermittent faults, which can help identify issues with voltage drop or loose connections. Also contained within the logs can be data that identifies why and for how long the system has been non- functional.



***"If you're not monitoring your EBS data and a crash occurs, investigators will know information about your business that you don't"***

Regardless of whether you undertake maintenance activities in-house, fully outsource them or somewhere in-between, you should ensure that you're periodically checking in on what your smart brake systems are telling you and taking appropriate action to keep things in-check.

# Coaching

## Celebrate excellence, coach challenges

For EBS data to have a positive impact on safety, we need to use it to support safe driving behaviours. This means we need to find ways to engage with drivers with higher-risk behaviours and to encourage them to alter their driving.

### The Leaderboard

One option that you can make part of your approach is to have a leaderboard showing which drivers have the lowest rate of stability control interventions.

This directly relates to smooth, low-risk and animal-friendly driving behaviours of the desired driving behaviour in the livestock industry.

By providing a measure of driving mastery which align to desirable driving behaviours, we support drivers to feel pride in their expertise without resorting to undesirable metrics, such as how quickly they drive.

You should not publish which drivers are performing poorly, make your celebrations of excellence public and your discussions about challenges private.

## The art of motivating people

While Australia's transport industry does trucks better than anyone else in the world, we don't always have a great track record in how we manage and inspire our people. While discussing challenging data from ESC, it is important to respect the innate human desire for mastery, autonomy and purpose.

### Your delivery

Make sure you have these discussions in private and avoid periods where the driver may already be stressed. Be clear and direct, but without being negative or confrontational. Outline the facts and why they're concerning to you.

*Manager: " Bill, I just wanted to have a talk about what we're seeing in the data from your trailer. Compared to the average of our other drivers, you're having nearly four times as many ESC interventions andI'm really worried that if we don't change something, you're likely to lay one over."*

Compared to:

*Manager: "Bill, why the heck do you keep driving too fast, I'm sick of your garbage and if you keep messing up, you'll be finding somewhere else to work."*

### Plan together

Give the driver the first opportunity to lead the plan for change. A good example of this is asking them "What do you think you could do differently to change these numbers?".

You also need to make it clear that you're open to hearing feedback as well as delivering it. Consider asking "Is there anything I can do to support you?".

Work through any questions the driver may have, but also understand that it can take time for the driver to process what they're hearing, so give them that time and space and make it clear that they can come back with any follow-up questions.

Finally, agree when you will check in next and what you're both hoping to see in the data at that time.

## Disclaimer

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