

PERFORMANCE-BASED HEAVY VEHICLE DRIVER FATIGUE MANAGEMENT TRIAL



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Abstract

This paper reports on findings of an innovative safety trial, the Alternative Fatigue Management System (AFMS) pilot trial, being undertaken in New Zealand.

Managing heavy vehicle driver fatigue is an internationally challenging issue, particularly given that drivers often work relatively long hours. Traditionally, the legislative approach taken by most international jurisdictions to manage driver fatigue is a prescriptive one. A prescriptive approach sets criteria, such as limiting on duty hours and requiring specific breaks to be taken however, it does not include performance evaluation of the driver's fitness to work. This Trial uses innovative science and technology and takes a blended approach of performance and prescriptive requirements. The aim of the trial is to provide greater flexibility with work time hours and reduce the risk of heavy vehicle drivers transporting livestock transport being fatigued while driving

The Trial includes: Transport Operator (business) commitment and management; driver fatigue training and management; a single source of truth that records and demonstrates compliance with the Trial requirements, for example: recording all driver, journey and scheduling/dispatch activity; and the use of a cognitive alertness test that is completed on a driver's smart phone.

The Trial began in July 2022 and finishes in May 2023. This paper reports on the findings to March 2023.

Keywords: fatigue management, flexible rest breaks, cognitive alertness test, performance based

1. Background

According to the Waka Kotahi NZ Transport Agency (Waka Kotahi), fatigue is believed to be a contributing factor in at least 12 percent of motor vehicle crashes. In terms of absolute numbers, Ministry of Transport reports that in 2016 fatigue was identified as a contributing factor in 28 fatal crashes, 119 serious injury crashes and 438 minor injury crashes. These crashes resulted in 36 deaths, 160 serious injuries and 574 minor injuries. Waka Kotahi reports that in 2020 fatigue was a factor in crashes involving 25 deaths and 113 serious injuries. Research shows that fatigue is difficult to identify and recognise as having a role in a crash (Williamson and Chamberlain, 2005), therefore the contribution of fatigue in crashes may be under-represented in the police-reported crash system.

It is widely accepted that being fatigued can impair cognitive ability as much as moderate alcohol intoxication.

The predominant regulatory approach to managing the risk of fatigue with commercial drivers is by prescribing maximum continuous and cumulative working periods. Work time includes all a driver's activities other than when they are resting, therefore it includes driving, loading and unloading, maintenance and cleaning, administration activities and paid employment whether or not related to transport activities.

Work time limits are prescribed in the Land Transport Rule Work Time and Logbooks 2007 (Work Time Rule) and are summarised as: drivers must take a break of at least 30 minutes after 5½ hours of work time, no matter what type of work takes place during that period.

In any cumulative work day a driver can work a maximum of 13 hours and then they must take a continuous break of at least 10 hours (as well as the standard half-hour breaks every 5½ hours).

A cumulative work day is a period during which work occurs, and that: does not exceed 24 hours; and begins after a continuous period of rest time of at least 10 hours.

A driver is limited to a cumulative work period of up to 70 hours after which a continuous break of at least 24 hours is required. It is a requirement that drivers record their work-time and rest breaks.

During late 2020 Waka Kotahi and New Zealand Police undertook a campaign on compliance of livestock transport drivers with the Work Time Rule. The results showed high levels of non-compliance, particularly with drivers not taking their 30 minute break after being on duty for 5 ½ hours. Cases were also identified where drivers had been on duty for more than the allowed 13 hours in a cumulative workday. There were no cases identified where the cumulative work period of up to 70 hours was exceeded.

2. Issues

In April 2021 Waka Kotahi met with Transporting New Zealand to raise its concerns regarding the high level of regulatory non-compliance. That led Transporting New Zealand to facilitate an Issues Workshop where livestock transport operators could share their views on the challenges they face. Government departments and agencies (Ministry for Primary Industries (MPI), WorkSafe and Waka Kotahi) attended primarily to listen and discuss those

challenges with the aim of achieving sector-wide agreement on the significance of those issues and potential remedies.

The Issues Workshop identified that the key reasons underlying non-compliance with the Work Time Rule were related to either: drivers not stopping due to concerns with animal welfare or drivers trying to make up for unplanned delays and needing to meet schedules. For example, a driver may not have stopped after 5 ½ hours on duty because it was a hot day and they could not find a place suitable to stop with shade and breeze which without would place the animals under considerable distress. With regard the pressure to meet schedules and locations, if drivers could not arrive at a processing plant at the scheduled time then penalties would be applied therefore drivers would elect to keep driving to avoid the penalties.

From a systems perspective a more important finding was that the issues that could reasonably likely be expected to be controlled, or arguably should already be controlled under chain of responsibility but are not, are largely due to influencers in the supply chain other than the transport operator. For example, the majority of volatility and uncertainty being faced by operators is largely a result of the business practices of farmers, livestock agents and meat processing plants.

In summary it was generally acknowledged that incompatible goals, and the inherent variability and unpredictability of their typical operating environment often made it impracticable to comply with the Work Time Rule during livestock transportation.

Transporting New Zealand proposed developing a quadripartite agreement between transport operators, farmers, livestock agents and meat processing plants that demonstrates those parties' commitment to their roles and responsibilities in managing a safe and sustainable supply chain.

However, recognizing that an across supply chain approach would take time to deliver tangible remedies, in parallel Transporting New Zealand and livestock operators wanted to explore possibilities of resolving the Work Time Rule non-compliance issues whilst ensuring the risk of fatigue was being managed.

3. Opportunity

3.1 Potential to better manage the risk and symptoms of fatigue

It is widely accepted that the general approach currently taken in the Work Time Rule has significant limitations in its effectiveness to manage fatigue. In 1996 the report of the Transport Committee on the Inquiry into truck crashes (NZ House of Representatives) refers: *“Even if all drivers filled out their log books correctly and still worked the amount of hours permitted, drivers could still be fatigued. The quantity and quality of rest taken by drivers and the activities they undertake outside of work, are key factors in whether or not they become fatigued while driving.”*

The current Work Time Rule does not include any mechanism of measuring an individual's actual state of alertness. A non-compliance or breach of the requirement to record a 30 minute break does not necessarily mean that a driver is fatigued.

In many cases of the non-compliance identified, a break had been taken but it was shorter than 30 minutes, or alternatively the driver had mistakenly considered that they had taken their rest during other times despite them technically still being at work. Despite the non-compliance with the Work Time Rule drivers perceived they were self-managing the risk of fatigue and arguably there is some validity in that thinking as is evidenced by the finding that fatigue was not identified as a contributing factor in an analysis of 5 years of livestock truck crash data.

Recent research and new technology provides the potential to significantly better manage driver fatigue by taking a more systemic risk management approach, for example including:

- Educational awareness
- Sleep analysis (identifying cases of sleep apnoea)
- Assessment of driver impairment
- Algorithms to analyse and assess driver fitness to work

Transporting New Zealand, Waka Kotahi, Police and MPI recognised the constraints and limitations of the Work Time Rule and consequently are supporting the undertaking of an Alternative Fatigue Management System (AFMS) pilot trial.

3.2 The concessions sought from the Work Time Rule

3.2.1 Variation of rest time

To vary the rest time limits by allowing a livestock driver to take periods of rest time totalling at least 60 minutes in every cumulative work day providing there is no more than 4 hours between each period of rest time.

3.2.2 Extended work day

To conditionally allow a livestock driver in any cumulative work day to record up to 15 hours of work time in order to deal with any unexpected circumstances. The word “unexpected” means an event or a situation which arises without prior warning or without any indication before the respective driver’s journey was dispatched.

3.3 Aims of the Trial

The aims of the trial are:

- 3.1.1 To test the effectiveness and ease of use of the digital systems which will be used to electronically collect real time welfare and fatigue related data from drivers.
- 3.1.2 To satisfy the operators and Waka Kotahi that by using the data collection systems, their drivers and dispatchers are able to make informed decisions as to whether the flexible hours permitted under this AFMS pilot trial can be used and if so, the nature of the countermeasures that will need to be applied. The data needs to be transparent, time stamped and recorded for easy auditing.
- 3.1.3 To identify issues that livestock drivers encounter relating to work and rest times, and develop insights on how livestock drivers deal with fatigue in order to complete their activities safely, and look after their health and wellbeing.

4. Trial governance and management structure

4.1 Legislation

Land transport rules are a form of secondary delegated legislation similar to regulations. Waka Kotahi produces rules for Te Manatū Waka The Ministry of Transport under an agreement made with the Chief Executive of the Ministry of Transport. Land transport rules are typically signed into law by the Minister of Transport or their delegate who is a Minister of the Crown under the *Land Transport Act 1998* (the Act), but they can also be made as Orders in Council.

A key difference is that regulations can set fees and charges, and can contain offences and penalties whereas, land transport rules cannot. The Work Time Rule has corresponding offences set out in the *Land Transport (Offences and Penalties) Regulations 1999*. The Act provides for the Director of Waka Kotahi to grant exemptions to specified requirements in a regulation or rule.

4.2 Enforcement

The on-road compliance of heavy vehicles with land transport rules is primarily enforced by the Commercial Vehicle Safety Team (CVST), a division of New Zealand Police.

WorkSafe is New Zealand's primary workplace health and safety regulator, and under the Health and Safety at Work Act 2015, a vehicle is considered as a place of work.

4.3 Subject matter expertise

Expertise in fatigue and the development of a systemic alternative fatigue management system was provided by Fit for Duty and its Managing Director Rachel Lehen. The integration of the digital system technology was provided and led by Boyd Peacock Director of GetHomeSafe.

4.4 Trialists

The trial began with 39 drivers from three livestock transport companies and a control group of 40 drivers was identified. A representative for the transport operators was appointed and the primary responsibilities of that role was to coordinate operational matters between the transport operators and Waka Kotahi.

4.5 Industry leadership and advocacy

Transporting New Zealand provides sector leadership predominantly in heavy vehicle road freight. Its roles included assisting with funding and liaising with Waka Kotahi on the strategic policy issues and impacts.

4.6 Trial management structure

The AMFS pilot trial has a two-tier management structure including:

A Governance Group which includes representation from Waka Kotahi, Police, Worksafe, Fit for Duty, the transport operators and Transporting New Zealand.

A Project Steering Group which includes: Fit for Duty as the AFMS pilot trial manager, Waka Kotahi and a transport operator representative.

5. Technology Stack

Trial participants used a solution that combines features from a number of technology providers. Each plays an important part in the complete picture of the AFMS pilot trial. A brief breakdown of each component follows below:

5.1 Prism

PRISM is a fatigue monitoring platform provided by Predictive Safety. Its biomathematical algorithm combines work time data with a driver's cognitive test data to provide a real-time and predicted fatigue status of the AFMS pilot trial participant. The driver's cognitive test data is collected and assessed through the AlertMeter® app referred in section 5.2 below.

PRISM utilises timekeeping data from whatever system is used at the site or on a provided login device to generate a time stamp when employees come onto the site. The information captured is sent to a risk calculator, which then predicts the fatigue risk based on the employees' recent work history and anomalies known to contribute to fatigue.

PRISM goes beyond scheduling alone by creating real-time analysis and real-time solutions. Using existing systems within the environment, PRISM alerts the employee that fatigue is impending, and ahead of the onset of fatigue, provides simple, validated countermeasures so the employee can stay alert. PRISM has proven to reduce fatigue-related incidents by 27% and reduce the cost of accidents by 70% while reducing hours worked in fatigue up to 38%.

5.2 AlertMeter®

AlertMeter® involves workers undertaking a graphical cognitive alertness test lasting 60-90 seconds. It has been shown through both clinical and workplace analyses as an effective way for employers to assess driver fitness-for-duty.

Originally validated in a NIOSH- funded 2009 clinical study, AlertMeter® has since been successfully deployed in a growing number of safety-sensitive organizations across industries, meeting the key requirements for a workplace-friendly alertness test, such as being brief, inexpensive to implement, portable, and not requiring proprietary hardware. AlertMeter® has been shown in real workplaces to increase productivity, reduce turnover, and lower costs of drug testing and workers' compensation insurance claims. AlertMeter® test scores have also been shown to correlate to time of day, indicating sensitivity to circadian cycles.

AlertMeter's® test interface displays different shapes that the user needs to identify accurately and quickly. The patented design does not simulate any particular job function, but

it challenges a number of key brain functions that are necessary for all jobs, measuring reaction time, decision-making speed, orientation, and hand-eye coordination. Users take the alertness test ten times to establish an initial baseline score, or individual performance standard. The scoring algorithm compares users' daily test results with their personal baseline scores. The system identifies compromised alertness when an employee's test result deviates significantly from his or her baseline. Psychological and physiological factors differ greatly between employees, so the only way to accurately measure individuals' cognitive states is to compare their performance in real time against their own personal baselines. By using a calculated baseline methodology, the system provides individual feedback rather than a score against an imposed standard.

Upon launching the test on their smart phone, the user is presented with an array of shapes. The user's task is to determine if all the shapes are the same (despite the shapes' rotation) or if one shape is different from the rest. If one of the shapes is different, the user then taps or clicks the one that is different. If all the shapes are the same, the user taps or clicks a green button that reads "They're all the same!"

5.3 ERoad/e-logbooks

It is a regulatory requirement to record work time and rest time and that can be done manually or by using an electronic system approved by Waka Kotahi. Drivers in the AFMS pilot trial used electronic systems so that data could be integrated by interfacing with PRISM and AlertMeter®.

5.4 GetHomeSafe

GetHomeSafe is real-time welfare monitoring software that combines and integrates information from the systems referred in sections 5.1, 5.2 and 5.3 above. It also provides fatigue management and training prior to onboarding using eLearning modules for each of the respective roles.

GetHomeSafe records the driver's actual work time, rest times and respective real time risk rates based on cumulative work time and rest time. It enables a driver to request extensions to the work-time rules referred in section 3.2 above. The requests are considered by the respective management team of the drivers and approved or declined based on the fatigue information readily available. Variations to rest breaks are recorded.

GetHomeSafe provides customisable reports on participant interactions with AlertMeter as well as a variety of other metrics and data. All this data is available for auditing and the GetHomeSafe system was considered as the "Single source of truth" for the AFMS pilot trial.

6. Initial results and findings

6.1 Numbers of concessions to the Work Time Rule

The trial drivers have so far been involved in approximately 26,200 hours of work time. The number of occasions when drivers have sought variations to rest breaks and concessions to extended hours are shown in Figure 1 and Figure 2 below.

Varied rest breaks

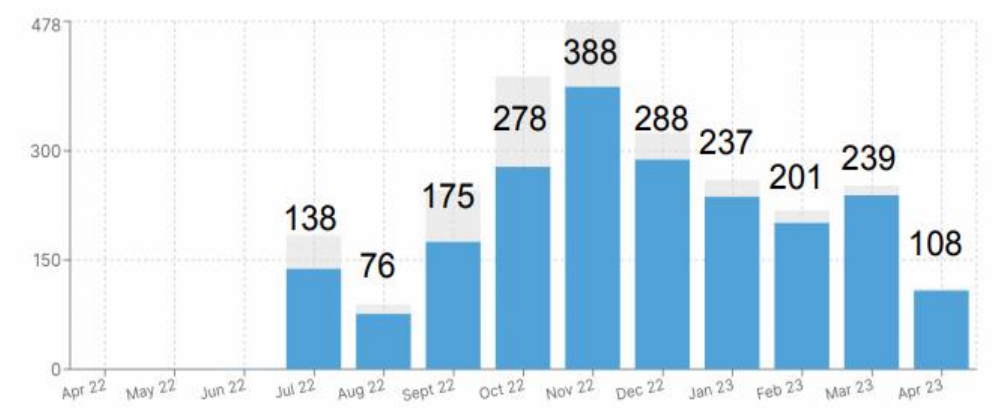


Figure 1 – The number of times drivers used varied rest breaks

Extended hours

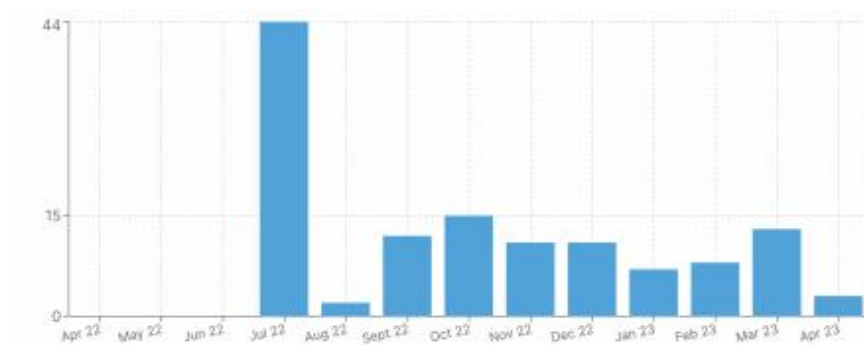


Figure 2 – The number of times drivers required extended hours

6.2 Trialist attrition

Currently 10 drivers from the initial trial size of 39 remain regularly using the system. The most dominating factor in the churn is the high turnover rate typically experienced in this sector. The next most dominating factor is falling driver engagement due to the relatively high complexity and personal invasiveness of the complete systems approach, particularly where sleep apnoea is identified.

6.3 Safety performance

There have been no accidents or incidents involving those drivers that took advantage of the increased flexibility to working and rest time that the trial provided.

7. Initial learnings

A full analysis of the trial has yet to be completed however, the following are initial learnings:

Transport companies would benefit from more Change Management expertise to help improve driver uptake and ongoing engagement.

There are some gaps in operators fully understanding and fully utilising the potential capability of the system and the user experience could be improved by changes to work flow.

Compared to other commercial vehicle safety initiatives, such as inward facing cameras, this systemic approach to alternative fatigue management is relatively complex and invasive for drivers, and that appears to be a barrier to engagement.

Waka Kotahi approves the eligibility of each of the drivers joining the trial. This takes considerable time and the administrative burden is a barrier to managing the relatively high driver attrition rate.

There is anecdotal evidence that empowering drivers with greater flexibility to manage their work breaks is beneficial to their respective wellbeing and mental state.

8. Summary

Compared to the baseline (managing fatigue by prescriptive work and rest time requirements) it appears indisputable that the use of a cognitive performance-based test provides a higher degree of confidence that a driver is not impaired. Therefore, better managing this risk should lead to improved road safety outcomes.

Furthermore, the cognitive test measures against an individual performance benchmark, and failure to meet that benchmark simply indicates a level of cognitive impairment. That impairment may be a symptom of fatigue however, it could also or alternatively be a symptom or effect of something else either legitimate (for example, mental stress) or illicit, (for example, drugs, alcohol). Therefore, the Trial system offers an improved way of managing risk of driver of impairment wider than fatigue.

There is increasing demand from other sectors in the road freight industry for greater flexibility with work time.

A larger sample and more data is required to validate the viability of this approach and an extension and amendment of trial conditions to reduce the complexity and administrative demands is being sought from Waka Kotahi.

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