

Heavy Vehicle Driver Fatigue Management: Specification for Electronic Work Diary

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ABSTRACT

This paper provides an insight into the draft performance-based specification for heavy vehicle driver fatigue monitoring systems, and implications that such systems present for stakeholders. The proposed specification is intended to enable the provisions under the national Heavy Vehicle Driver Fatigue (HVDF) legislation for the use of Electronic Work Diaries (EWDs). The specifications have been developed by Transport Certification Australia Limited.

The HVDF legislation took effect in Queensland, New South Wales, Victoria and South Australia in September 2008. These laws allow operators, employers and drivers more flexible working hours in exchange for more rigorous management of driver fatigue.

The HVDF legislation allows for the use of electronic record keeping devices, also known as EWDs.

To date, authorities have not approved any EWDs due to the technically ambiguous provisions contained within the HVDF legislation.

Recognising this, the Australian Transport Council requested the development of a performance based specification for heavy vehicle driver fatigue.

Enabling electronic record keeping will present stakeholders with opportunities to make changes in other areas. For example, transport operators could elect to use EWD systems to generate management reports, or authorities could elect to introduce non-roadside compliance and enforcement practices.

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1. International adoption of in-vehicle telematics

Governments around the world have demonstrated an interest in promoting and supporting the use of in-vehicle telematics in road transport.

For example, the United States has supported the adoption of in-vehicle telematics since 1991 (NTC 2010a). Over the last decade in the United States, the focus has been on allowing older vehicles to install newer on-board units - giving such vehicles access to newer user services and ensuring vehicles do not require multiple units (NTC 2010a).

In the European Union there is a focus on using interoperable systems and infrastructure to deliver competitive and efficient transport (NTC 2010a). An example of this is a current initiative to consolidate Dedicated Short Range Communication applications, Global System for Mobile communication applications and Global Positioning System applications into a single on-board unit (NTC 2010a).

Alternatively, in Japan, in-vehicle telematics are seen as a platform on which to build functionality, rather than primarily as a solution to a defined problem such as congestion of the road network (NTC 2010a).

In Australia, the Intelligent Access Program has been operational since 2008, allowing heavy vehicles improved access to the road network in return for their compliance with specific access conditions (NTC 2010b).

2. Heavy vehicle driver fatigue management in Australia

Heavy Vehicle Driver Fatigue (HVDF) legislation took effect in Queensland, New South Wales, Victoria and South Australia in September 2008. These laws present transport operators, employers and drivers with three options for fatigue management (NTC, 2008 p. 27 - 46). These options are:

- Standard Hours – provides basic work and rest limits;
- Basic Fatigue Management – provides more flexible work and rest hours linked to operator accreditation and training of drivers; and
- Advanced Fatigue Management – provides the ability to create one's own safety management system and set one's own work hours (within defined limits), linked to operator accreditation and driver training.

Drivers currently use Paper Work Diaries (PWDs) to record their hours of work and rest. This is a cumbersome process — requiring written declarations from the driver, manual interrogation of records at the roadside and physical passing of records between stakeholders.

Recognising this, the HVDF legislation also allows for the use of electronic recordkeeping devices, known as Electronic Work Diaries (EWDs). EWDs have the potential to allow more efficient compliance checking (Circuitlink International, 2009, P.2), improve compliance (Department of Transport, 2009, p.1), improve trip planning and mitigate fatigue risks (Department of Transport and Main Roads, 2009, p.2).

However, no EWDs have yet been approved for use on Australian roads. A recently developed draft EWD specification is expected to help facilitate such approvals (TCA, 2009). This has implications for both public and private policy makers.

This paper begins by discussing the need for the draft EWD specification in Australia, before detailing some aspects of the specification itself. It then discusses implications of enabling EWDs, and considers the opportunities that EWDs may present for authorities, transport operators and EWD suppliers.

3. The need for the draft EWD specification

Since the HVDF legislation was enacted in four states in 2008, no EWDs have yet been approved for use on Australian roads. This is because the HVDF legislation allows state road authorities to approve EWDs, but does not provide sufficient detail of the operational requirements of an EWD.

Such operational requirements would feature not in legislation, but in accompanying guidelines published by the Australian Transport Council. Authorities are required to refer to such guidelines when considering whether or not to approve an EWD (NTC 2008 p. 66).

However, such guidelines or specifications have not, to date, been completed. With reference only to the HVDF legislation, authorities have not been prepared to approve devices as EWDs, as there is no measure to ensure that such devices represent an interoperable and evidentially sound solution.

For example, one key requirement of the work diary is that it can provide a driver's records of work and rest to an enforcement officer at the roadside. The HVDF legislation does not detail the method and format for presenting records at the roadside. This means that devices which produce varied outputs of records at the roadside can be submitted for approval. Were such systems to be approved, a driver operating one brand of EWD could present an enforcement officer with records on a hand-held digital reader, while a driver operating a competing brand of EWD could present records on a USB memory-stick, a paper-based print out or even in the form of an electronic file for Bluetooth transfer.

Such a situation would not represent a workable solution for authorities - and as a result no EWDs have been approved for use on Australian roads.

The HVDF legislation is also silent on:

- the security and protection of electronic records.
- the identification and authentication of drivers.
- interoperable transfer of records between vehicles, transport operators and record keepers.
- any controls necessary to protect the evidentiary quality of records.

Recognising the need for EWD guidelines, the Australian Transport Council (ATC) at its November 2008 meeting called for the "development of an Australian performance-based specification for electronic heavy vehicle driver fatigue systems, enhancing the use of in-vehicle telematics and adding value to the Intelligent Access Program" (NTC, 2009, p. 1).

Transport Certification Australia (TCA) was engaged to develop this specification, which the ATC may elect to publish as complimentary guidelines under the HVDF legislation.

TCA has delivered a draft EWD specification to Austroads, and expects to consult with stakeholders and finalise the specification for delivery in 2010.

It should be noted that the ATC, in calling for the development of such a specification, has not mandated any use of EWDs, other than providing the capacity for imposition by courts of law. Furthermore, TCA's role in preparing the draft EWD specification was to assist

authorities with considerations of approval of EWD technology; TCA did not have any role in the development or modification of road transport policy.

4. Factors shaping the development of the draft EWD specification

Factors which influence the development of the Draft EWD Specification include the Heavy Vehicle Driver Fatigue legislation, direction from the Austroads Steering Group, equivalence to the PWD, operational logic, the general philosophy of the project and the EWD system requirements. Each of these factors is discussed in turn below.

4.1 Heavy Vehicle Driver Fatigue legislation

HVDF legislation enacted in 2008 in Queensland, New South Wales, Victoria and South Australia is the dominant influence over the Draft EWD specification.

As such, the Draft EWD specification is completely aligned with the HVDF legislation, except in the following three instances:

1. **Measurement of time** - The HVDF legislation requires that time is counted in 15 minute intervals (HVDF National Model Legislation, NTC, 2008). The specified EWD counts time to a resolution of 1 second.
2. **Indication of successful transmission of records** - The HVDF legislation requires that EWDs have a mechanism that indicates to the driver successful or failed transmission of records (HVDF National Model Legislation, NTC, 2008). The specified EWD does not have such a feature, but instead features error-detection and error-correction procedures which achieve error-free transmission of records. These procedures negate the need for the mechanism required in the HVDF legislation.
3. **Officer annotation** - The HVDF legislation requires that EWDs permit an officer to annotate a driver's records, to show the time and location of an inspection. The specified EWD does not permit officer annotation.

There are also a number of operational aspects of EWDs about which the HVDF legislation remains silent. As a result, additional direction was required for the development of an effective and functional Draft EWD Specification. The influences outlined in sections 2.2 – 2.5 below provided this direction.

4.2 Direction from the Austroads Steering Group

TCA was engaged to prepare the Draft EWD Specification by Austroads Ltd. As part of this engagement, Austroads formed an EWD Steering Group comprising senior officers of state road authorities.

The Austroads Steering Group was able to provide clarity in a number of cases where the EWD requirements were unclear. These included EWD interoperability and the passing of records between stakeholders of the EWD system.

However, the group was unable to provide guidance on some of the more technical aspects of EWDs, including data security.

4.3 Equivalence to the PWD

In a number of technical aspects where the HVDF legislation is ambiguous or vague, the Austroads Steering Group instructed TCA to look to the existing structures and systems supporting the PWD in order to determine specifications for the EWD.

As PWDs represent a robust and reliable (if cumbersome) system, the support structures and systems associated with PWDs are considered to be a strong base for determining what an EWD system should incorporate in order for it to function as required.

In order to draw sound comparisons with the PWD, analysis was completed to identify the processes and associated qualities which make the PWD system robust and reliable. Similar qualities were then incorporated into the Draft EWD Specification.

Key processes and qualities of the PWD are shown below in Figure 1.

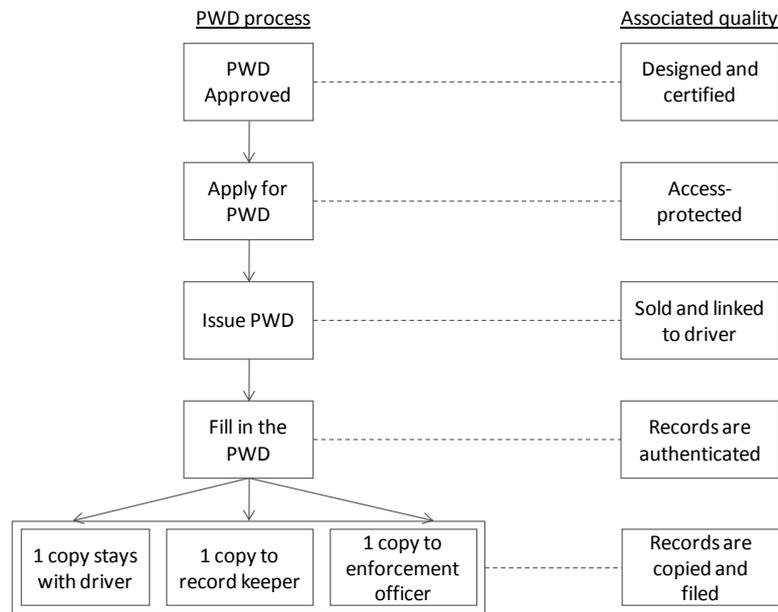


Figure 1: Processes and associated qualities of the PWD

As can be seen in Figure 1, when the driver applies for the diary, authorities link the PWD to the driver's identity. In this way, authorities can track whether drivers are using the diary that they have been issued, and consequently detect drivers using multiple diaries at any one time.

This has been noted as a particularly important feature of a work diary (NTC, 2009 p. 11) and as such, similar controls feature in the draft EWD specification.

4.4 Operational logic

The Draft EWD Specification does not emulate the operation of the PWD in each and every way. This is because in order for EWDs to be operational and functional, it is not possible for EWDs to emulate the PWD in some instances and inefficient in others. In such cases, basic operational logic shaped the development of the Draft EWD Specification.

One aspect in which the Draft EWD Specification does not emulate the PWD is the measurement of time. The specified EWDs will measure time to a resolution of one second, whereas the PWD currently measures time to a resolution of 15 minutes.

This difference was included in the Draft EWD Specification for the basic operational reason that electronic systems inherently offer greater accuracy for automating the recording of time than was originally required in the manual PWD system, which is reliant on a person using a wristwatch and a pen. This can be seen in the commercial systems currently in use, which already record time to the second, in comparison to the 15-minute periods recorded in the PWD.

Furthermore, were electronic systems to round time to the nearest 15-minute period as defined in the HVDF legislation, ordinary use of such systems would be expected to

regularly generate days of records which add up to greater than 24 hours. Such inaccuracies would not be acceptable in courts of law, which is a key requirement for EWDs.

Considering this, it is neither possible nor efficient to require equivalence between the PWD and EWD with regard to the recording of time, as this would require the downgrading of technology already in use on Australian roads and common in electronics devices around the world.

4.5 Philosophical approach to the specification

The philosophy adopted in developing the Draft EWD Specification was based on the following guiding principles:

1. Where possible, the specification should be performance-based, only being prescriptive where necessary to achieve interoperability. This allows EWD suppliers the freedom to develop innovative EWDs that best serve drivers and transport operators. It also ensures that systems are interoperable enough to allow drivers to move quickly and easily between systems and/or vehicles and Enforcement Officers to quickly and easily inspect a driver's records regardless of which EWD system that driver is using.
2. The specification should envisage a multi-application telematics environment, supporting both commercial needs and the needs of the Authority. That is, EWDs should be capable of running commercial applications for drivers and transport operators while performing the regulatory functions governments require of EWDs both now and in the future. This would allow transport operators to realise commercial benefits from investments in EWDs.
3. The specification should cater to existing work/rest options (Standard Driving Hours, Basic Fatigue Management and Advanced Fatigue Management) and should be flexible to allow drivers to take up any future fatigue management options that authorities may permit. This allows drivers to use EWDs regardless of which work/rest option they are currently working under, and ensures that the same EWDs can be used should governments permit additional work/rest options in the future.
4. The specified EWD should be capable of accurately measuring date, time and location. Governments have recognised that this is of critical importance because EWDs should not compromise the safety benefits afforded by the HVDF legislation (Department of Transport and Main Roads, 2009, p. 1).

4.6 Requirements of Electronic Work Diaries

After consideration of the five factors outlined in sections 4.1 – 4.5 above, EWDs were identified to have the following requirements:

1. Accurately recording the work and rest periods of the driver,
2. Providing records of work and rest to a record keeper,
3. Providing records of work and rest to an enforcement officer at the roadside,
4. Having sufficient integrity to assist with the enforcement of offences within the HVDF legislation,
5. Being able to travel with the driver, regardless of which transport operator or vehicle the driver is working within,
6. Being highly reliable, and
7. Being usable by the driver.

The next section outlines key elements of the Draft EWD Specification.

5. The Draft EWD Specification

The EWD system is required to serve the stakeholders defined in the HVDF legislation, namely the driver, transport operator, authority, enforcement officer and record keeper.

Put simply, EWDs allow the driver to show their compliance with the work/rest options permitted in the HVDF legislation. A simple overview of this is shown in Figure 2.

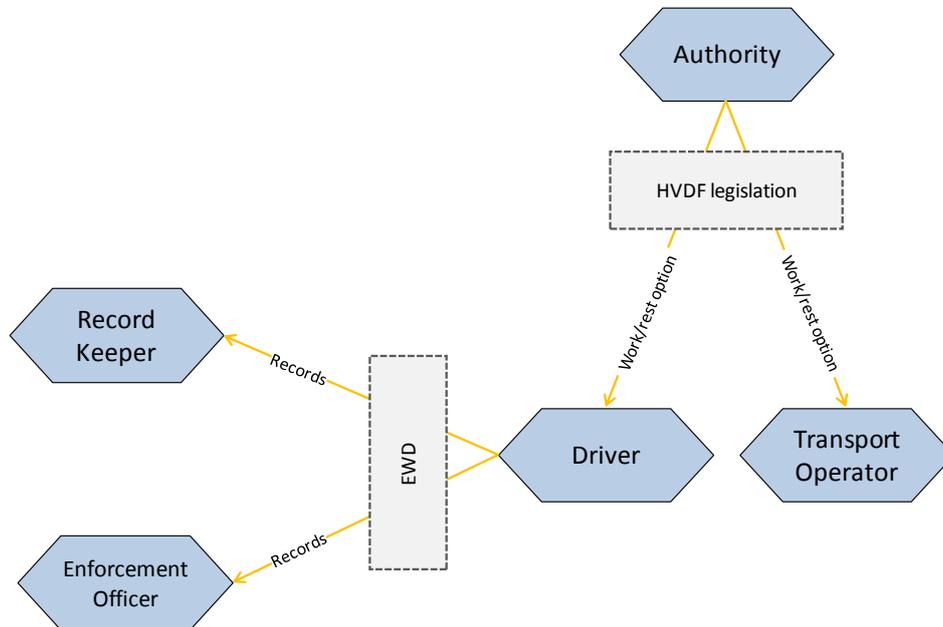


Figure 2: Simple operations of the EWD systems

The rest of this section considers the stakeholders in the EWD system, and briefly outlines three key processes in the operation of EWDs.

5.1 Driver

The driver is responsible for declaring work times, rest times and the locations of each to the EWD system. Each driver must also have a method of identification and authentication, in order to identify themselves to the work diary. (Identification and authentication is achieved by means of the driver's signature in the PWD).

As identification and authentication is not required for interoperability, it is expected that the identification and authentication method will be proprietary to EWD system installed in the vehicle, and only interoperable between systems of the same brand or type.

5.2 Transport operator

A transport operator is defined in the HVDF legislation as a person who is responsible for controlling or directing the operations of the heavy vehicle.

In relation to the EWD, the transport operator elects to engage an EWD supplier to install the EWD System in the regulated heavy vehicle.

The transport operator may also engage the EWD supplier to install commercial or non-regulatory functionality on the EWD system. This would be a business decision for the transport operator to consider, after weighing up the commercial offerings available from EWD suppliers.

5.3 Enforcement officer

The enforcement officer is responsible for inspecting the driver's EWD records and determining the driver's compliance with the HVDF legislation. This would usually be performed on the roadside, and require the driver to provide the EWD records to the enforcement officer for inspection.

5.4 Authority

The authority is responsible for maintaining the HVDF regulations. In doing this, the authority would be responsible for permitting any additional work/rest options. In addition to this (as currently occurs in the PWD system), authorities may periodically audit the EWD records held by a record keeper.

5.5 Record Keeper

The record keeper is responsible for maintaining records as specified in the HVDF legislation.

It is important to note that the HVDF legislation permits the record keeper to engage the services of another person to assist in performing the record keeping function. The implications that this carries for the introduction of EWDs are discussed further in section 6.3 of this paper.

However, if the record keeper were to engage the services of another person to assist with the keeping of records, the record keeper would retain some liability for any record keeping offences committed.

5.6 The movement of records within the EWD system

EWD records move with the driver between vehicles, bases and employers. To enable this, EWD records are not stored solely on an EWD system's in-vehicle unit.

EWD records are robustly protected from deletion or tampering when created, read and moved between vehicles, bases or employers. Critically, however, this does not hinder a driver's ability to read or move EWD records.

5.7 The availability of records to enforcement officers at the roadside

EWD systems allow enforcement officers to inspect a driver's records at the roadside. This is a quick, simple and safe process, not requiring enforcement officers to enter the cabin of the vehicle.

Enforcement officers interrogate the driver's EWD records using an authority-provided remote data terminal (laptop, PDA or similar). This allows the authority's systems to determine the driver's compliance with the applicable fatigue management option of the HVDF legislation.

It is important to note that the EWD, like the PWD, does not determine the compliance of the driver. Compliance or otherwise is determined through assessment by the enforcement officer.

5.8 The availability of records to the driver and record keeper

There are two types of records within the EWD system: driver declarations and GNSS-generated location records. Both driver declaration records and GNSS-generated location records are available to the driver and record keeper.

The driver retains records for carrying between vehicles, bases and employers. The record keeper (if not the driver) receives a separate, identical copy of both driver declaration records and GNSS-generated location records. The record keeper maintains records as required by the HVDF legislation.

6. Changes associated with enabling electronic work diaries

There are two key changes associated with the introduction of EWDs. The first is that the records of work and rest represented in the EWD will be more reliable than those represented in the PWD. This is because in the specified EWD system, it will be possible to quickly and easily check the accuracy of driver declarations, through comparison with GNSS-generated date, time and location records.

It is worth noting that governments have already demonstrated confidence in the accuracy of GNSS-generated date, time and location data. The Intelligent Access Program, already in operation on Australian roads, is an example of such.

It should also be recognised that checks on the accuracy of drivers' work and rest declarations are already carried out in the PWD system. Using fuel receipts and other trip data, authorities can build a case against a driver's declarations of work and rest. However, drivers are aware that this is an uncommon and cumbersome process, and some drivers regularly make false declarations of work and rest in the PWD, knowing that such declarations are not likely to be verified against other data. In this way, it is possible for drivers to conceal HVDF offences.

This problem is no secret, and deliberately deceptive declarations in the PWD have been extensively documented. Indeed, some involved with the road freight transport industry openly mock the integrity of the PWD system, referring to the PWD as a 'lie book' (Roads and Traffic Authority, 2009, p. 4).

The specified EWD system, however, will facilitate the straightforward identification of false work and rest declarations at the roadside, by removing the administrative hurdle of having to build a case against false declarations of work and rest. This will enable enforcement officers to take prompt action to enforce HVDF legislation, which can be expected to translate into improved heavy vehicle road safety outcomes.

The second key change associated with any move from the PWD to the EWD is that authorities and transport operators will have an increased awareness of offences that occur. Currently, in the PWD system, it is only possible for authorities and transport operators alike to identify a driver's false declarations in instances of extreme breaches, which only make up a limited number of cases. The EWD system, on the other hand, may allow a far greater number of false declarations and fatigue breaches to be identified – independent of where and when such declarations are made, even if they only represent a minor breach of the HVDF legislation.

Enabling EWDs would, for the first time, allow for the immediate transmission and analysis of regulatory records of work and rest. This presents stakeholders with opportunities to make changes in other areas. Three such opportunities are considered below.

6.1 Transport operators could link EWDs to a broader package of information technology

Transport operators may be able to gain increased efficiencies within the logistics chain by incorporating EWDs into a broader package of information technology with links to payroll, work scheduling or safety systems. One simple example would be to link the GNSS-generated location records from an EWD system to the transport operator's back office map, in order to track the location of goods and vehicle location over time.

It should be noted that linking vehicle operation to other logistical systems will not be a new concept for many in the road transport industry. Indeed, many transport operators have already installed commercial electronic systems that record work and rest, and linked these to other business systems. Such commercial systems, though, do not create records of a standard currently recognised by authorities to be acceptable for regulatory purposes.

Therefore, one of the key changes associated with enabling EWDs is not the technology at all; it is instead that commercial logistical systems could now have access to a highly reliable, legally-robust stream of data. This will provide certainty that has until now been lacking.

EWDs could also allow transport operators to receive direct alerts of drivers breaching the HVDF legislation whenever a driver exceeds the limits of their work/rest option. This would allow transport operators to act on breaches while the driver is out on the road, rather than after the event when the driver returns to their base as currently occurs in the PWD system. In this way, transport operators could immediately act to minimise the severity of any breaches of the legislation, and ensure that drivers do not unwittingly compromise compliance.

A further example would be to link a driver's work records to the transport operator's payroll system. This would ensure that as a bare minimum, drivers would be paid for all hours at the wheel. A further benefit of linking EWD work records to back office payroll systems is that transport operators could better manage Chain of Responsibility obligations, as they could demonstrate that they do not pay drivers for any hours worked which are not declared in the EWD.

6.2 Roadside enforcement of work and rest limits could be phased out in favour of exception-reports sent to authorities

The introduction of EWDs may also enable authorities to review their compliance strategies. Once records are digitised, it is a relatively simple step to automate analysis and detection of HVDF offences. Providing records of such offences to authorities would then allow authorities to act against offenders, negating the need for roadside interrogation of work diaries.

This would allow authorities to better direct funds currently spent interrogating work diaries into other aspects of heavy vehicle road safety. For example, the time enforcement officers currently spend inspecting work diaries could instead be spent on more detailed roadworthy checks.

Alternatively, should authorities elect to focus resources on increasing the number of detections over time rather than the depth of inspections that already occur, authorities could elect to hold each vehicle for less time but stop and inspect a greater number of vehicles. Either option would be expected to promote better heavy vehicle road safety outcomes.

6.3 EWD suppliers could assist record keepers by taking on part or all of the record keeping task

Digitising records also presents an opportunity for the record keeper (be that the employer, driver or transport operator) to engage the services of another person to assist with the record keeping task.

As noted earlier in this paper, the HVDF legislation allows the record keeper to engage another person to assist with the record keeping task, but does not allow the record keeper to pass on liability for record keeping offences. Digital records could be easily, simply and reliably transferred (for example by email) and stored (for example in specialised, secure data warehousing facilities). This would be a much simpler and faster process than is currently required to transfer and store PWD records (a process involving physical passing and filing pages of records).

Engaging a specialist company to assist with the record keeping task could therefore allow transport operators, drivers and employers to spend less time on administering records, allowing more time to be spent on profitable business activities.

7. Conclusion

The introduction of EWDs is expected to lead to a number of changes for drivers, transport operators and authorities. EWDs would allow more efficient interrogation of work diary records than is currently possible in the PWD system, which may allow for increased identification of breaches of the HVDF legislation as well as false declarations of work and rest.

The introduction of electronic record keeping associated with the enabling of EWDs presents stakeholders with opportunities to realise safety, efficiency and compliance improvements. Such opportunities warrant thorough consideration, as transport operators, drivers, authorities and others involved in heavy vehicle road freight transport will look to maximise the benefits of any investment in EWD systems.

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Disclaimer

The views expressed in this paper are those of the author. Transport Certification Australia does not necessarily endorse the views expressed.

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