

A worker in a high-visibility vest is working on a commercial vehicle wheel. The worker is wearing a yellow and grey high-visibility vest, dark pants, and brown work boots. They are leaning over the wheel, which is mounted on a vehicle. The background is a light grey, semi-transparent image of the vehicle's side and rear. The text is overlaid on the top half of the image.

EVALUATING COMMERCIAL VEHICLE WHEEL SAFETY: **HOW TO KEEP SAFE AND STAY COMPLIANT**

Contents

The current landscape	3
Problem wheels	4
The problem with ‘spider hubs’	5
How to spot problem wheels – a 10-point checklist	6
The implications of getting it wrong	9
Three ways to keep your fleet safe	10
The future: the steps being taken to ensure road safety	12

▲ This whitepaper outlines the key risks affecting commercial vehicle wheels, the challenges the transport industry must overcome, and the potential implications of the current environment not improving. It also highlights how fleet operators can implement best practice maintenance checks and procedures to ensure their vehicle wheels are fit for purpose, as well as some easy-to-follow ways to keep your fleet safe.

Brought to you by MWheels Ltd., formerly MWS Distribution Ltd.

Version 1.1 June 2017.

The **current landscape**

Commercial vehicles are subject to a wide range of stresses and strains on the road, which results in increased forces placed on the wheels. As such, wheel safety is a critical issue for fleets, but continues to be largely overlooked across the industry. This low level of awareness, coupled with the rising number of commercial vehicles is giving cause for great concern – raising the risk of legal action and ultimately, the number of road traffic accidents and the safety of drivers.

In 2015, there were 120,500 articulated vehicles registered to the UK, according to the Department for Transport (DfT) – a 5% increase from the previous year.¹ With more vehicles on the road than ever before, the likelihood of accidents continues to grow. The Campaign for Better Transport states that heavy goods vehicles (HGVs) were implicated in more than half of fatal motorway accidents and one in five fatal accidents on A-roads in 2013.²

Compared with other vehicle types, this figure has been climbing each year.³ Despite the risks that are placed on commercial vehicles every day, there hasn't been any data available on wheel detachments from heavy vehicles, or even on the number of accidents caused by wheel failure, since the Transport Research Laboratory report in 2006, that found there were between three and seven fatalities a year – just from wheel loss alone.⁴

The current scale of the problem is therefore unknown, as no further action has been taken by the DfT or Driver and Vehicle Standards Agency (DVSA) since this time.

With this lack of reporting, it is unsurprising that awareness remains low regarding the impact of wheels on road safety, despite them being such an important element of commercial vehicles. 10,000 haulage firms in the UK are on the DVSA 'red list' because of the threat they pose to other road users. Risks include hauliers' failure to ensure adequate maintenance and safety.

It is testament to the current commercial vehicle landscape that following the report, DVSA chief executive Gareth Llewellyn said the regulatory system was 'ripe for review', paving the way for new practices and legal requirements to be implemented.⁵

¹ DVLA/DfT, 2016

² Campaign for Better Transport, 2013

³ Metropolitan Transport Research Unit (MTRU), 2013

⁴ Transport Research Laboratory, 2006

⁵ DVSA, 2017

Problem wheels

Not only do unsafe commercial vehicle wheels put drivers at risk, they can also cause loss of vehicle control, putting others in danger, or lead to significant damage to the rest of the vehicle – incurring costly repairs. It is therefore imperative that any potentially dangerous wheels are identified early and replaced as soon as possible.

Some imported wheels do not have sufficient markings or tests carried out to ensure road safety. Furthermore, it is easy, but highly risky, to fit a tyre with a maximum load capacity of 5,000kg onto a wheel with a maximum load of 4,500kg. Meanwhile, some wheels do not carry a stamp stating the maximum load. Using just the tyre as a guide can therefore easily lead to overloading of the wheel. A widespread challenge in the aftermarket is that there is currently no stamp that says the wheel is compatible with the vehicle to which it is being fitted – only a manufacturer stamp. Particularly when buying from markets such as the Far East where quality standards can vary, it can be difficult for fleet operators to know the type of wheels they're purchasing.

With the quality of wheels in the aftermarket varying to such a degree, how can fleet operators be sure their wheels are fit for purpose?

As well as the challenges facing fleet operators in the aftermarket, roadside replacement is also a key issue for safety, as it's more difficult to ensure the consistency of correct wheels on a single axle, and on the vehicle as a whole. With the number of commercial vehicles on the road growing, the likelihood of potentially faulty wheels that fail to deliver maximum performance for operators is higher than ever.

Some roadside replacement practices are therefore raising questions on the procedures currently in place. For example, it would improve both safety and performance if the fleet manager double-checked wheel suitability each time a vehicle has any off-site work carried out.

The problem with ‘spider hubs’

There continues to be a lack of awareness on wheel products that can cause long-term damage to commercial vehicles, such as varying hub shapes. According to ISO 4107 ‘Commercial Vehicles – Wheel Hub Attachment Dimensions’, the outer hub shape should be a continuous diameter.⁶

However, industry analysis has found that there are various other shapes of hubs in operation that do not follow these standards, such as non-circumferential hubs (called ‘star’ or ‘spider’ hubs).⁷ Used by fleet operators on commercial vehicles to reduce weight, they are still commonplace in the market. But research by members of the Association of European Wheel Manufacturers (EUWA) showed that non-circumferential hubs reduce fatigue life of the wheels by up to a half. Due to the higher load stresses and strains the hubs must withstand, the wheels can crack prematurely along the edges of the star shape. Where there are other factors affecting the commercial vehicle, such as overload, reduced connection between wheel and hub and reduced service conditions, cracks can easily appear. This excessively costly and potentially dangerous situation can easily be remedied by the immediate removal of all spider hubs.

However, there could be repercussions in the industry following the research. Fleet operators may be required to contact hub and wheel manufacturers, as products originally replaced or refunded under warranty may no longer be considered if the product is shown to have operated on a spider or star-shaped hub. The findings also suggest that more rigorous vehicle maintenance, service schedules and MOT tests would be beneficial, adding extra costs and more downtime to an industry where margins are already tight.

Further in-depth research has also found that failed or worn studs are the primary cause of road incidents. Settlement, insufficient torqueing and incorrect lubrication of threads and interfaces, lead to friction losses.⁸ Over-torqueing of wheel nuts is a common problem because it feels natural that ‘tighter is better’. But this can stretch the stud and compromise the clamping force, leading to the studs shifting out of position, loosening and ultimately compromising the whole wheel mounting. This can be potentially lethal, as when wheels become detached from a moving vehicle, they can accelerate up to around 150km/h, reaching a height of 50m before colliding with other vehicles or road users at an equivalent force of 10 tonnes.⁹



⁶ ISO 4107:2010 ‘Commercial vehicles – wheel hub attachment dimensions’, 2010.
⁷ Technical safety report produced by Wheels India Ltd – available from MWheels on request.
⁸ IRTE wheel security guide
⁹ IRTE wheel security guide

How to spot **problem wheels**

There are several checks that fleet operators can perform before and after fitting wheels to commercial vehicles. With the use of the right tools, these preliminary measures can help to ensure optimum safety and compliance with the regulations. It is important to note that in the case of any doubt concerning safety features, the wheel must not be fitted.

A 10-POINT WHEEL CHECKLIST TO ENSURE SAFETY ON THE ROAD

These checks are not complex or overly time consuming and can be completed during a standard walkaround of the truck. Making them part of your routine will ensure your vehicles are safer.



1 Dents & damage

- A badly dented wheel will not run true and may not seal correctly, so look for any damage that distorts the wheel from its original shape
- If there is excessive wear in the flange thickness, the wheel is effectively defective and should be replaced; it is not repairable. Use a Flange Wear Gauge to measure the tolerance
- The consequences of cracked or damaged wheels may be severe; including failure, or the wheel becoming detached from the vehicle and leading to serious injury or death. It is imperative therefore, that cracked or damaged wheels are removed from service immediately.

2 Cracks

Cracks can appear:

- From ventilation hole to ventilation hole
- From ventilation hole to stud hole
- From ventilation hole to rim
- As a result of overloading or sharp edges
- From stud hole to stud hole, caused by over tightening, loose wheel nuts, or over tightening in the wrong sequence
- On the disc curve, due to incorrectly sequenced fitting, damaged hub, or overload.

Look for circumferential cracks (all round cracking):

- At the tyre bead seat, because of moisture or pitting
- In the wheel well, due to over-inflation, corrosion or overload
- At the attachment weld, due to overload/over-inflation, or a loose wheel.

Signs of cracking include:

- Leaks under the tyre bead
- In the well and at butt weld.

3 Signs of under-inflation

- Look for wear along the circumference of the tyre bead seat on the rim.

4 Corrosion

- Any surface corrosion of the wheel rim can be wire brushed and cleaned (taking care not to use any abrasive materials on the centre bore)

- Excessive flaking or badly pitted metal indicates a need to scrap the rim.

Areas to check include:

- Around stud holes on the nave
- Both mating surfaces of the nave
- Around the centre hole or bore on the nave
- Bead seat on the rim
- Around the valve hole on the rim
- All welds
- Around vent holes, front and back
- The wheel well.

5 Markings on nave plate or the reverse-side of the rim

Located in different places on forged aluminium and steel wheels, markings include:

- Wheel size
- Offset (some wheels do not contain this)
- Max load capacity ('load index'). Where not contained in the markings, always refer to the manufacturer's specifications
- Date of manufacture
- Name of manufacturer or manufacturer's stamp
- Part number.

These markings are to assist with wheel compatibility between the tyre and vehicle. No tyre should be fitted to a wheel without these markings as they do not conform to ETRTO standards.

6 Mating surface

- All contact or mating surfaces on the wheel nave and axle hub must be clean, smooth and corrosion free
- Look for signs of heat damage caused by attempted removal of seized wheel nuts.

7 Centre hole or bore

- Check the centre hole or bore for signs of warping, a dent or buckle in the nave
- Look for damage to the edge or severe corrosive pitting around the circumference, that would be sufficient to affect the centring and full contact mating of the wheel
- No abrasive materials should be used when cleaning the centre bore, to avoid going beyond manufacturers' tolerances.

8 Stud holes

Thoroughly inspect all stud holes for any sign of wear or damage. As an aid, you may use a stud hole tester such as a No-Go Gauge. For stud hole centring, no tolerance is allowed on the stud hole. Any 'ovality' will mean the stud hole is not fit for purpose, with a possibility of stress lift, leading to breakdown between nut washer and wheel surface, effectively loosening the wheel nuts.

In terms of a tightening sequence, it is important that the first two nuts are finger tight.

Stud holes may elongate due to:

- Too much torque
- Loose nuts or washers
- Incorrect nuts.

All of which could lead to incorrect centring causing loosening and/or cracking of the wheel.

9 Paint thickness

To protect steel wheels, they are coated with anti-corrosion primer and top coat. Industry preference is not to have paint on mating surfaces, so minimal and even coverage needs to be checked. However, points to note are that paint is degradable and that excessive paint thickness on the attachment face (over 60 microns) will affect the clamping strength of the wheel nuts.

10 Valve hole

- The valve hole surface must have a clean and even surface
- The valve hole area must be free from burrs and sharp edges
- Any leak at valve hole is caused by damage or severe corrosion.

Note that the use of protective hub covers makes simple checks much more time consuming (they need to be removed), and that the inside wheels on a twinned axle are also more complicated to check sufficiently.

The implications of **getting it wrong**

Despite the recommended measures that are in place, it remains difficult to regulate the wheel industry, and there are calls across the industry to provide more guidance about wheel safety. The lack of appropriately stringent requirements serves to highlight the stark differences in legislation between countries in Europe.

For example, in Germany, the individual wheel purchaser (usually the owner, technical or fleet manager) can be charged with manslaughter should a wheel fail and cause a catastrophic incident. There is also a corporate manslaughter law in the UK – the Corporate Manslaughter and Corporate Homicide Act 2007 – but this only addresses the company directors' liability. A company director can be charged for manslaughter following failure to apply a full risk assessment in the purchase of a wheel. The law applies to those cases where serious management mistakes have resulted in a 'gross breach of a relevant duty of care'. It is therefore crucial to have a record of where wheels have been purchased – and ensure they are from reputable sellers.

With Europe-wide legislation due to come into force in 2018 covering wheel procurement, it is becoming even more important to know whether commercial vehicle wheels are fit for purpose. The impending legislation about 'period roadworthiness tests for motor vehicles and their trailers and repealing Directive 2009/40/EC' has set out seven strategic objectives and identified actions for safer vehicles.

The new law aims to add further weight to the Corporate Manslaughter and Corporate Homicide Act 2007, and addresses the argument that non-circumferential hubs ('spider hubs') are causing untested load stresses, leading to cracks and halving the life expectancy of a wheel, creating serious safety concerns. It also calls for more stringent periodic and roadside tests, with emphasis on the wheels. The law brings into context several minimum essential requirements that need to be stipulated when purchasing second-hand or potentially inferior wheels, as well as the key roles that will be played by commercial vehicle fleet managers and product purchasers.

3 WAYS TO **KEEP YOUR FLEET SAFE**

By incorporating the following three points into the wheel purchasing behaviour of fleet managers, it is possible to increase the number of safe wheels on the road, which could in turn lead to fewer commercial vehicle accidents.



1 Commercial vehicle wheel best servicing practice

It is important that the service manager performs regular vehicle checks, ensuring that nothing is missed. Attention should be paid to the inside and outside attachment faces on wheels, as this is where cracks may appear prematurely if using non-circumferential hubs, for example. In cases where cracks have been detected, it is crucial that the wheels are replaced immediately. As well as the service manager, it is necessary to improve drivers' education to encourage more regular vehicle checks. But it is not enough to simply identify loose nuts or wheel damage; drivers must also be made aware of the next steps to be implemented, to ensure vehicle safety.

Daily walkaround checks are crucial. A visual check is essential, followed by a physical check, if needed. Drivers are also legally required to report any defects in writing. Annually, fleet operators should remove the wheel completely to check for damage.

2 Traceability of supply using a robust procurement process

For wheels to be fully compliant and roadworthy, full transparency along the purchasing line from the source is necessary. However, current legislation means that a wheel could be involved in a serious accident, potentially incurring serious damage, but be back on the road the next day, with no record of its history. With the right procedures in place, fleet operators can have control, compliance and a full audit trail.

There are several questions that fleet managers should ask themselves about the wheels they purchase:

- Do you know where the wheels were sourced?
- Did they receive a full risk assessment?
- Are they second-hand or take-off wheels?
- Are they inspected on a regular basis?
- Who is responsible if the wheel fails?
- If you are replacing a wheel, how are you able to prove your assessment of the replacement? Is the wheel sufficiently stamped, for example?
- Has anyone in your organisation undergone wheel training?

There is growing evidence of forged certification and false 'CE' marking entering the industry. To keep yourself safe from the implications of this, you need to purchase your wheels from a reputable supplier.

3 Choosing the correct wheel and fittings

While due care and attention should be taken to ensure that commercial vehicles are regularly checked for damage, it is also advisable that the proper advice be sought when choosing the correct wheel and fittings. However, with inconsistent levels of quality in the wheel industry, from the standard of the metals used, through the manufacturing processes, and of course the labelling procedures, only certain manufacturers currently provide fleet operators with the information they need. Therefore, increased wheel data being made available would make it easier to match the wheel to the hub when wheels need changing. Selecting the correct fittings and accessories to the wheel are equally crucial, as the wrong components can lead to wheels loosening.

The future: **the steps being taken to ensure road safety**

It is becoming increasingly important for wheels to be considered an integral part of commercial vehicle safety. Particularly considering the upcoming European-wide roadworthiness legislation, there will be more emphasis on the requirements of fleet operators and how they could be liable if there is an accident on the road, together with the costs incurred if their vehicles are taken off the road after failing the tests.

When enacted, the new European law will lead to wheels being recognised for being safety critical – which should lead to more effective DVSA tests and safer vehicles on our roads. In the future, the traceability of products operating within fleets, including wheels, will be critical to a safe and reliable commercial vehicle industry. As awareness of the right type of wheel for the vehicle grows, fleet operators and manufacturers can work together to help to optimise fleet performance.

Maintaining the correct wheels and maintenance programme not only affects road safety, it also carries other benefits for fleet operators. For example, operating costs can be reduced with the right wheels on the vehicle, as loads can be optimised and fleets are able to carry more. By following the three steps outlined in this report, fleet operators can have the confidence that their fleet is fit for purpose. Partnering with reputable companies, such as MWheels, will mean there will be a technical expert on-hand to advise on any issues, and to check they are correct for the vehicle type and sector in which they operate.



A wireframe illustration of a commercial vehicle chassis, shown in a light blue color, set against a light grey background. The vehicle is viewed from a front-three-quarter perspective, showing the front end, the driver's side, and the rear. The wireframe highlights the structural components of the vehicle, including the front grille, headlights, hood, roof, side panels, and rear section. The wheels are also depicted as wireframes, showing the hub and tire area. The overall image has a clean, technical, and modern aesthetic.

About **MWheels:**

MWheels is one of Europe's leading independent distributors of commercial vehicle wheels for a wide range of sectors. With over 35 years of experience in the European wheel market, MWheels offers customers a single point of supply for all their commercial wheel needs. Supported by the team's unrivalled technical expertise, innovative solutions and high stock availability, MWheels can provide peace of mind both during your purchase and afterwards. For further information, visit: www.mwheels.co.uk

MWheels Ltd
(Previously MWS Distribution Ltd)
50 Leestone Road
Sharston Industrial Estate
Manchester M22 4RF

+44 (0) 161 908 1023
sales@mwheels.co.uk

WWW.MWHEELS.CO.UK

MWHEELS
EXPERTS BEHIND THE WHEEL